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INFORMATIONSDIENST **HOLZ**

Can **nature** be harmful?

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The extent to which analytically determined nVOC limit values can stigmatise untreated wood in interior spaces as a health risk; and the reliability of LCI values..

Facts and legal situation

Photo: Oliver Iserloh

Our forests, as renewable resources and organic CO_2 sinks, contribute significantly to the protection of the climate. Our robust native pine trees with their deep roots are particularly capable of withstanding climate change. Due to its large market share, this tree species has long been an important asset with high innovation potential for the timber industry. As a renewable resource it has countless varied uses, many in the area of construction, particularly in interior spaces: as attractive surfaces for walls and floors as well as sturdy floors and modern design furniture.

Like all building products, the natural volatile organic compounds (nVOCs) released by wood influence indoor air quality. If an apartment is not aired sufficiently, the guideline values stipulated by the German Environment Agency (UBA) for substances such as terpenes and aldehydes contained in timber products can be exceeded in indoor air quality measurements. While this does not present any health risk, in the worst case it can lead to a legal dispute, because the nVOC guideline values (GVs [1]) are considered hygiene recommendations. If they are shown to be exceeded, discussions about defects in timber constructions often follow.

On the other hand, the toxicologically founded and health-specific evaluation parameters (LCI values; LCI = lowest concentration of interest), which are determined in laboratory product tests by the Committee for Health-related Evaluation of Building Products (AgBB), are very relevant in terms of health. However, in these assessments, the allowed amount of nVOCs is more than ten times higher than that allowed in indoor air quality analysis. This is just one reason why it is not possible to reliably predict concentrations of emissions in indoor air from product-specific emission values determined in laboratory tests.

[1] GV / guideline values
GV I = precautionary value
GV II = health hazard value

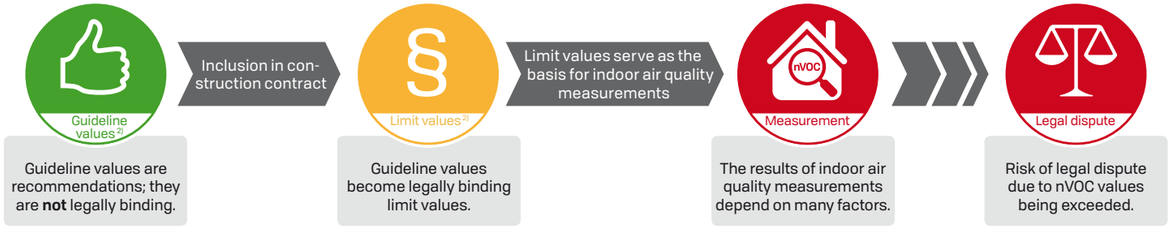
Substance	Product test LCI value	Indoor air quality measurement GV1) I UBA
Acetaldehyde	1200 µg/m³	100 µg/m³
A-pinene	2500 µg/m³	200 µg/m³
Limonene	5000 µg/m³	1000 µg/m³

Photo: Kühnlein Architektur, Berching

Timber surfaces render interior spaces warm and comfortable – in both traditional and modern architecture. In sufficiently well-aired rooms most people perceive the substances emitted by wood as pleasant and natural. However, the current nVOC guideline values stipulated by the German Environment Agency can give rise to legal dispute, even though the LCI values are not exceeded and there is no risk to human health.

Photo: Rainer Sturm/pixelio.de

[1] Höllbacher, E., E. Srebotnik, R. Marutzky: Indoor emissions. A study on various sources of volatile organic compounds in a close-to-reality model room, Institute of Chemical, Environmental and Bioscience Engineering, TU Wien, 2016, www.vt.tuwien.ac.at



[2] Guideline values become legally binding limit values if they are included in the construction contract and checked on final acceptance.

Measurement methods and risks

Photo: IQUH

In contrast to nVOC guideline values, which are measured inside actual rooms and depend on various aspects (ventilation, climate, measurement errors, cumulation of different products, etc.), the material-specific LCI values determined in test chambers accurately reflect the health limit values for each individual material. This is particularly relevant for wood as a natural material, as it allows the reliable assessment of its actual influence on indoor air quality. Not only for laymen is it difficult to understand that a timber product may pass the product test only to exceed the limit values in individual indoor air quality measurements. For this reason, it is crucial that the UBA guideline values for nVOCs be reviewed and adjusted.

Results obtained in test chambers differ from those of indoor air quality measurements due to their diverging conditions, which confuses both designers and consumers, particularly because the measured indoor air quality values are unpredictable and often higher than expected owing to the larger number of external influences and higher risk of measurement errors.

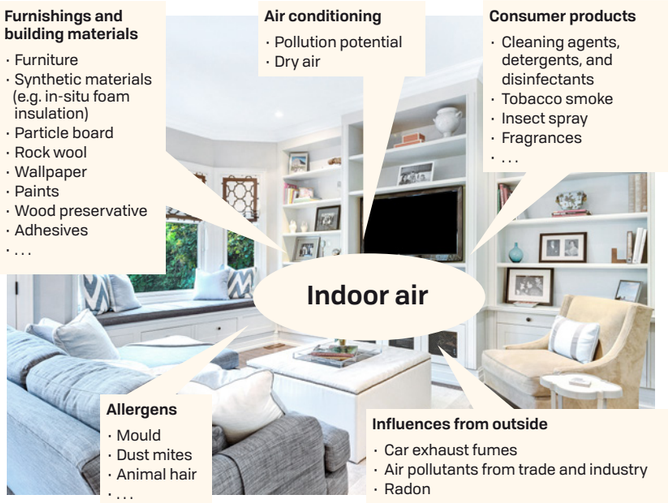


Photo: André François McKenzie/unsplash.com

[3] DIN EN 16516:2018-01 (Tests for building products --> NEW!)
This standard prescribes the methods for measuring the release of dangerous substances under laboratory conditions. It determines the emissions from construction products into the indoor air – without any external influences and under constant room conditions.

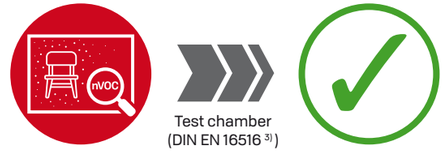
[4] DIN ISO 16000 (Indoor air)
Series of standards concerning the methods for measuring VOCs in interior spaces. VOC values depend on indoor climate conditions (temperature, humidity, and ventilation rate) and hence can differ from those measured under standard conditions. This could lead to legal conflicts.

[5] Ventilation rate 0.1 = no air conditioning; indoor climate and ventilation planning according to DIN EN 15251 (ventilation and comfort standard) is required

Indoor air quality is influenced by many emissions, and indoor air quality measurements also have very different testing criteria from laboratory tests. It is therefore not surprising that in the final acceptance, indoor air quality is often rated as critical even though the installed products passed the laboratory tests.

Testing conditions	Test chamber	Indoor air
Temperature	23 °C ± 1	19 – 24°C
Rel. humidity	50 % ± 5	20 – 80 %
Ventilation	0,25 – 2	approx. 0,1 [5]
Room	predefined	unique
Products	one product	combination
Time of measurement	after 3 and 28 days	at final acceptance, after the room has been closed for 8 hours

Problem: The indoor air quality values are generally higher due to the uncertain testing conditions



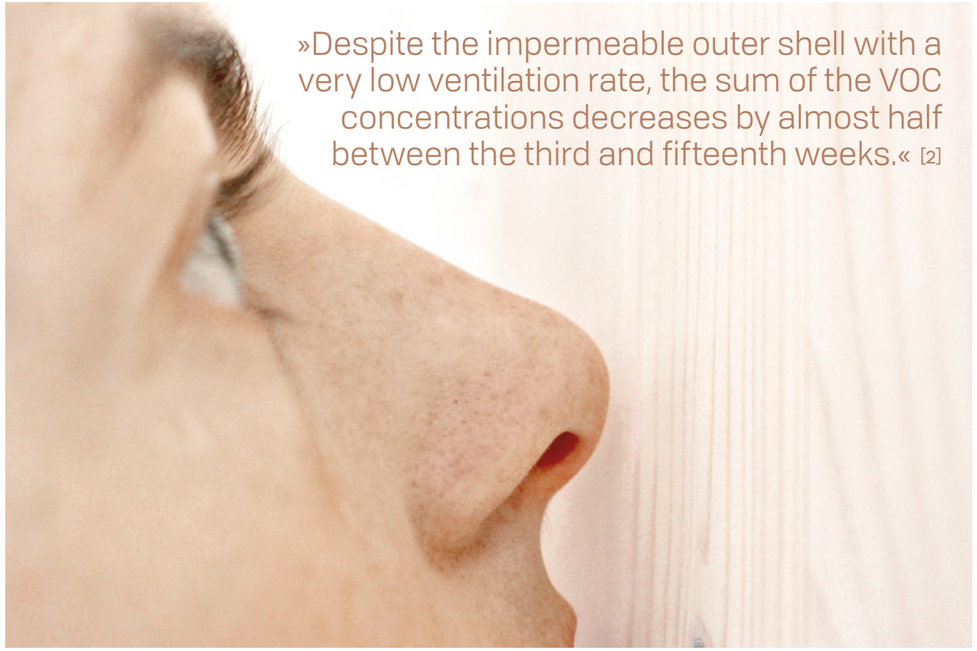


Photo: IQUH

[2] Schulte-Hubbert, F., A. Rehmers, A. Schuster, R. Gminski, J. Hurraß: Measurements of indoor emissions during erection of modern timber houses. Innenraumluft, in: Gefahrstoffe – Reinhaltung der Luft 73 (3), S. 81-86, www.uniklinik-freiburg.de/iuk

Research and health

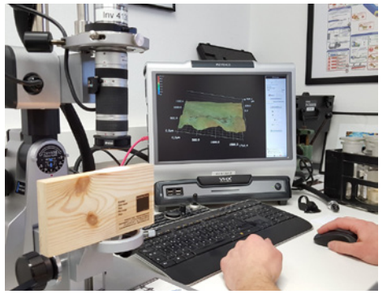
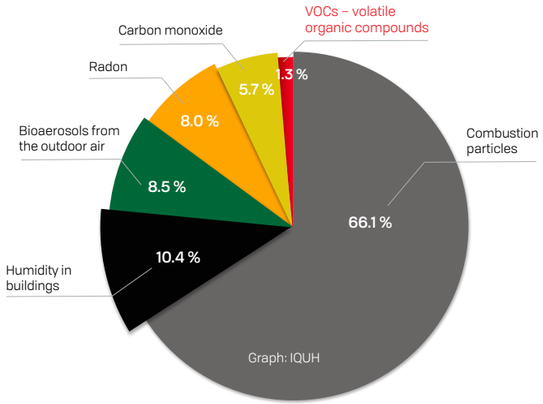


Photo: IQUH

In the meta study HOMERA [3] carried out by the Technical University of Munich, more than 42 individual studies were scrutinised, all of which dealt with the effect of wood on the indoor climate and thus on humans in closed spaces. The result is not surprising: The smell of wood in closed living and working spaces is comfortable and increases performance, as much as a walk in the forest is healthy and refreshing. Results of in-vivo studies [4] further indicate that terpenoids used within chemopreventive and chemotherapeutical approaches actively contribute to fighting lung cancer. The pie chart shows: With a fraction of only 1.3%, the influence of VOCs on diseases caused by polluted indoor air is much smaller than that of the other parameters shown. Wood interiors can even prevent dementia [5].

The many studies and research results show that the health-relevant significance of the guideline values for nVOCs published by UBA should be questioned. The longstanding experience with wood as a building material further shows that the typical wood smell decreases rapidly and even high concentrations can be dispelled quickly by airing, without any danger to human health. What smells good in the forest cannot be harmful for people in their apartments.



The nVOCs emitted by wood are included in the 1.3% VOCs. Their influence on human diseases caused by polluted indoor air is therefore negligible [6].

[3] HOMERA – Gesundheitliche Interaktion von Holz, Mensch und Raum. Meta study of the Technical University of Munich, 2017, available online at http://www.hb.bgu.tum.de

[4] Thoppil, Roslin J., A. Bishayee, Terpenoids as potential chemopreventive and therapeutic agents in liver cancer, Baishideng Publishing Group Co., 2011, www.ncbi.nlm.nih.gov/pmc/articles/PMC3182282/

[5] Tokie Anme, et al.: Behaviour changes in older persons caused by using wood products in assisted living, Faculty of Medicine, University of Tskuba, Ibaraki, 2012, www.md.tsukaba.ac.jp

[6] Matti Jantunen, et al.: Promoting actions for healthy indoor air (IAIAQ), EC/JRC/IHCP, 2011, ISBN 978-92-79-20419-7

[7] R. Gminski, et al.: Sensorische und irritative Effekte durch Emissionen aus Holz- und Holzwerkstoffen: eine kontrollierte Expositionsstudie, Institute for Infection Prevention and Hospital Epidemiology and Institute of Medical Biometry and Statistics, Medical Center – University of Freiburg, 2011, www.uniklinik-freiburg.de/iuk

»Neither the increase in VOC concentration nor a change in VOC composition leads to noticeable health problems for eyes, nose, or throat.

The smell is the only thing that users notice, and they tend to like it.« [7]

Photo: Adolf Bereuter, Dornbirn