

Options for legal regulations concerning indoor pollution – Do we need a “TA Innenraum” ? ¹

1. The problem

Formaldehyde, pentachlorophenol, polychlorinated biphenyls, asbestos, tobacco smoke, building products, household chemicals, pesticides – much more could be added to this list of pollutants and sources of pollutants, whose presence in the indoor environment has agitated people’s minds during the past years. Also, health effects that are associated with these pollutants and their sources, such as cancer, asthma and allergies, the sick building syndrome or other unspecific illnesses, have pointed to the relevance of indoor air pollutants to human health. Consumers continue to ask what authorities are doing to protect them against – hypothetical or real – threats.

In this situation, it is not surprising that the call for a “TA Innenraum” ¹ emerges time and again. Obviously, it is borne by the desire to solve indoor problems with a tool that has proven successful in other environmental areas, such as outdoor air (TA Luft), noise (TA Lärm) and domestic waste (TA Siedlungsabfall).

The problems of a comprehensive regulation have been addressed several times in the past, e.g. in the concept of the German Federal Government for better indoor air quality (Konzeption der Bundesregierung zur Verbesserung der Luftqualität in Innenräumen), published in 1992: *“There can be no comprehensive regulation for the large number of compounds and groups of compounds that pollute indoor air from different sources and via diverse mechanisms In the opinion of the Federal Government a successful improvement of the current situation can only be achieved by the use of several instruments for action and their joint application.”* Or in the report on priority fields of action to improve indoor air quality (Bericht zur Verbesserung der Luftqualität in Innenräumen – Ausgewählte

¹ The expression “TA Innenraum” refers to administrative regulations issued in the past (cf. 2nd paragraph of this text). The first of these was that for outdoor air, “TA Luft” (Technical Instructions on Air Quality Control). The full title of TA Luft, which was first issued in 1964 and has been updated several times since, is “First General Administrative Regulation Pertaining to the Federal Immission Control Act”.

Handlungsschwerpunkte aus Sicht des BMU², published by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) in March 2005. In this report, the BMU points out that *“there are no comprehensive requirements in the form of laws, ordinances or other legally binding regulations. This applies not only to the situation in Germany, but is also the case at the international level.”*

2. Pollutants in indoor air

There is a large variety of sources that have a negative impact on indoor air quality and contribute to interactions between indoor air quality and the indoor climate. These are mainly the fixed and mobile parts of the residential environment, i.e. construction materials, wall paper, carpeting, etc., as well as furniture and textiles, which are important due to the large surface areas they cover and the fact that often they emit pollutants continuously over long periods of time. Users of these spaces may influence the presence and quality of some of these sources, while this is not the case for others. This implies different possibilities for emission control.

The type and composition of construction products has changed considerably over the last decades. For many applications, the traditional materials stone and wood were replaced by products that are manufactured using chemical compounds. These products give rise to emissions of a multitude of volatile organic compounds (VOC). Similar phenomena can also be observed for furniture and other furnishings. Often there is insufficient qualitative and quantitative information on the compounds used in construction products and furnishings and on their health effects.

The concentration level of indoor pollutants is also determined by the quality of outdoor air: Due to the permanent exchange between indoor and outdoor air which takes place even when windows and doors are closed - via cracks in walls and joints of all kinds - certain amounts of pollutants continuously enter indoor air from the outside. Therefore, clean outdoor air is one of the important conditions for clean indoor air.

Humans pollute ambient air directly by exhaling carbon dioxide and giving off body odours. In the middle of the 19th century Max von Pettenkofer published a hygiene-based guideline value of 0.1 % (v/v) for carbon dioxide in indoor air. In subsequent decades, when humans were still the main source of indoor air pollution, this value was used to define ventilation requirements. The value is still valid, although a value of 0.15 % (v/v) can now be found in German DIN standards.

Other relevant pollution of indoor air can occur during activities that people carry out indoors. Some of these activities are essential for human life (cooking, washing, and cleaning), others are not (tobacco smoking, and burning of candles or joss-sticks). The use of washing and cleaning products as well as household and hobby products, and of cosmetics also contributes to indoor air pollution.

In addition to the quality of indoor air, whether chemical or microbiological, the indoor climate plays an important role for human wellbeing. The important parameters here are room temperature, air humidity, and air movement. The effect relationships between these indoor climate factors and the factors that have an impact on indoor

² www.bmu.de/files/chemikalien/downloads/application/pdf/bericht_innenraumluft.pdf

air quality are complex and often still unclear. However, there is scientific evidence, for example, that with no change in pollutant concentration health complaints increase with increasing room temperature. Air humidity is also an important factor. Excessive humidity can cause water vapour to condense on cool surfaces, especially walls, with the risk of mildew growth and negative consequences for the occupants.

3. Possibilities for action

Factors to take into account in evaluating the possibilities for action against indoor pollution include not only the quality and extent of possible health hazards, but also the possibilities that people have to protect themselves from such pollution. Personal lifestyle and individual behaviour cannot and should not be regulated. As a matter of fact, unlike outdoor air, the air in the residential environment belongs to the private sphere and is not subject to government control. Here, information and education are the appropriate tools to induce behaviour change.

The situation is different with regard to those sources to which people are exposed without any possibility of intervening directly – even in their private sphere – , such as many products used in construction. In their case authorities have to make sure that people can be confident that these products pose no health risk. Setting minimum requirements, to be complied with in construction and use, should also be considered for public buildings. Among other reasons, this is dictated by the large number of people who work in and visit these buildings and by the state setting an example in preventive health protection.

Irrespective of the type of the building and the use of the different rooms an improvement of indoor air quality can reasonably be achieved by:

1. Reduction or prevention of emissions,
2. Setting of concentration levels not to be exceeded,
3. Removal of air pollutants by ventilation.

These three objectives can, in principle, be achieved by one or several of the following tools:

- Legal or other governmental regulation,
- Normative standards,
- Voluntary agreements of manufacturers of products and compounds with relevance to indoor air quality,
- Information and education of the public.

3.1 Reduction or prevention of emissions

As for other areas of environmental protection, it is also true of indoor quality that it is preferable to combat the problems at source, i.e. to prevent emissions as far as possible. This maxim finds its limits where people cause pollutants to be released to indoor air to meet their basic needs.

Pollutant reduction and prevention are the main options to be considered in the case of emissions from permanent sources in the room (building products, furnishings) and from a number of indoor activities (painting and renovation works).

Legal or other governmental regulation

For enclosed spaces, there is no comprehensive specific legal basis, such as the Federal Immissions Control Act for outdoor air, to define the requirements for indoor air quality. The major reason is that indoor air pollutants result from different sources and causes (cf. section 2) which in turn are subject to different legal provisions. These include the laws governing chemicals, construction products, foods, commodities and feeding stuff, washing and cleaning agents, biocides, protection against infections, and pesticides, to name the most important.

For example, one possibility improve indoor air quality is provided by the Construction Products Act of 1992, which transposes European Union Directive 89/106/EEC of December 1988 into national law. However, both the German Act and the European Construction Products Directive (CPD) contain only general requirements, for example with regard to hygiene, health and environmental protection which need to be further specified with regard to indoor air. It is the position of the European Commission that according to the CPD only those regulations will be regarded as applicable that have been introduced at the national level and notified at the European level.

In principle, limiting emissions from products is possible via ordinance. In view of the multitude of product categories and the intense fluctuation of products on the market, this solution will only be applied in certain cases. One example would be construction products which are an integral part of the building, if they represent a threat to the environment or the health of occupants and if subsequent emission reduction would be unnecessarily onerous.

The legal provisions referring to chemicals, such the Chemicals Prohibition Ordinance (ChemVerbotsV), offer the possibility to ban specific compounds totally or widely, and therefore, to ban their use indoors. Examples of indoor relevant compounds addressed in this ordinance are formaldehyde, pentachlorophenol, and polychlorinated biphenyls (PCB). This has resulted in considerable emissions reduction for individual compounds, mainly for formaldehyde.

The evaluation scheme developed by the Commission on the health-related evaluation of construction products (AgBB; www.umweltbundesamt.de/building-products/agbb.htm) could form a good basis for measures according to Article 17 of the Chemicals Act. This article allows bans or restrictions to be imposed on specific dangerous substances, or products that contain such substances. The article can also be used as an additional basis for proposals for control measures in the framework of the European Existing Chemicals Programme. The goal of any such efforts is to guarantee the level of protection that exists in Germany and to feed it into the European discussion on the CPD.

Mandatory product labelling can also be an appropriate tool to improve indoor air quality. Labelling would give sensitive individuals in the population (allergic persons) valuable guidance in room decorating and furnishing and make the absence or a low level of pollutants an essential criterion for selecting a product. Therefore, a comprehensive product labelling obligation would be useful. Article 3 of the Chemicals Act provides the relevant empowerment.

REACH, the new European regulation on chemicals (Registration, Evaluation, and Authorisation of Chemicals) will have an impact on German chemicals legislation. Under REACH, within a period of several years, only such chemicals should be on the market as have been tested for environmental and health effects and are safe for the intended uses. REACH will also have a positive impact on the indoor environment, because the improved availability of data on properties relevant to the environment and to health will permit users of these chemicals to select less harmful or even harmless compounds, for example in the construction and the furniture manufacturing sectors. In addition, the public will get better access to information on chemicals. An improvement of indoor air quality will also result from the fact that for products imported from countries outside Europe there will be requirements for notification and registration of chemicals that can be emitted from these products.

An alternative to measures under chemicals legislation is regulation under building law. Regulation in this area, which is under the authority of the German Länder, offers the possibility to take action to avert hazards and thus permits to limit the presence of compounds in indoor air under certain circumstances. One example is the limitation of formaldehyde emission from chipboard for construction, which came into force in 1980. The requirements laid down at that time very quickly proved to be a valuable “model” for the quality of chipboard used for other purposes, e.g., in the manufacture of furniture.

Normative Standards

According to general understanding professional standards describe the current and generally accepted state of knowledge. Therefore, court decisions frequently rely on such standards. However, in most cases, the object of these standards is not so much a reduction of emissions as the definition of consensus methods to test product emissions in a reproducible way. Over the past years such standards for test chamber methods to determine emissions of volatile organic compounds from building products have been developed at the European level (CEN standards) and transferred subsequently into German standards (DIN).

Voluntary agreements

This way to achieve lower levels of pollutant concentrations in indoor air will be successful in all those cases where manufacturers can expect an advantage from a voluntary agreement. One example is the award of a quality label such as the German Blue Angel (<http://www.blauer-engel.de>), through which a manufacturer can expect to improve his market position.

Consumer information and education

The behaviour of the users of indoor spaces can make a crucial contribution to good indoor air quality. In many activities and for many products it is up to them to reduce emissions. However, they must be given the requisite information, e.g., about appropriate ventilation during product use. Choosing a “clean” product is also possible since the emission behaviour of the product is increasingly included in the test results published for the relevant products.

Smoking is a particularly significant factor for indoor air quality. Here, informing the public about the health risks of tobacco smoking both to smokers themselves and to non-smokers is most important.

3.2 Setting of concentration levels not to be exceeded

During the past decades, the setting of concentration levels not to be exceeded, for the various environmental compartments, e.g., ambient air quality standards, has proved to be an appropriate tool to improve environmental quality. In Germany, there are guideline values for indoor air for about a dozen of compounds and group of compounds. These guideline values, which are not legally binding but have only the character of recommendations – indeed, they are not “limit” values –, do not regulate sources directly. The same is true of ambient air quality standards (AAQS). For AAQS, the question of measures to achieve compliance is likewise not dealt with until the standard has been set, as shown by the recent debate on fine particulate matter.

Legal or other governmental regulation

The setting of any legally binding concentration levels entails the need to monitor compliance. With regard to private indoor environments it has to be examined how and by what institution the relevant activities should be carried out.

In addition, due to the multitude of potential sources, it is difficult to identify the reasons for exceedances of a concentration level in indoor air, particularly because the concentration levels may also be influenced by personal behaviour and lifestyle. As a rule, such identification is only successful for specific compounds emitted from defined sources. In the majority of cases it is not possible to identify the source as clearly as to permit the initiation of targeted remedial measures.

Despite this situation it is conceivable that at least some of the indoor air guideline values could be made more binding by using them to define requirements for indoor air quality in, e.g., calls for tender for the construction of public buildings such as schools or kindergartens. Such requirements would represent an indirect way to avoid high-emission construction products and furnishings.

Normative standards

Daily practice shows that there is a need for concentration levels that can give health-related information on the quality of indoor air. For such purpose the guideline values mentioned above have proved to be useful. During the last years such guideline values have been derived for both inorganic and organic compounds by a working group composed of members of the Federal Environment Agency's Indoor Air Hygiene Commission and representatives of Länder health authorities. In this activity, a transparent basic scheme developed and published in 1996 is used as a basis. The guideline values are published and are available on the Internet (<http://www.umweltbundesamt.de/uba-info-daten/daten/irk.htm#4>). Although they are not legally binding they are frequently referred to in court decisions and thus have reached a *de facto* official status.

Leaving aside the old “Pettenkofer value” referred to earlier, i.e. the value of 0.1 % in volume for the indoor air concentration of carbon dioxide, the first “new” guideline

value, namely that for formaldehyde, was derived in 1977 by an expert group. It is based on hygienic and toxicological considerations. The expert group had been convened by the then Institute for Water, Soil and Air Hygiene of the Federal Health Office. This guideline value of 0.1 ppm has been adopted in many countries since, and is almost identical to the 0.1 mg/m³ value recommended by the World Health Organization in its Air Quality Guidelines. Based on the 0.1 ppm level a limit value in the legal sense of the word has been set in Germany for formaldehyde emissions from uncoated wood products and furniture in a test chamber (cf. Annex IV of section 3 of the Chemicals Prohibition Ordinance).

Guideline values should be combined with information on how to check compliance, i.e. with procedures for measurement strategies and analysis. Over the last years, the Federal Environment Agency, through participation in the German Clean Air Commission ("Kommission Reinhaltung der Luft im VDI und DIN"; www.krdl.de), has systematically helped provide such information. Procedures for indoor measurement strategies and analysis of indoor air are laid down in the VDI 4300 and 4301 guideline series, respectively. Especially, the various parts of the VDI 4300 series have also attracted international attention. They are being introduced successively in the work of the International Organization for Standardization (ISO) and form the basis of the ISO 16000 series.

Voluntary agreements

Voluntary agreements make little sense where concentration levels to be respected have been defined. They are a useful instrument to commit manufacturers not to use specific compounds. Since limiting the occurrence of a compound in indoor air cannot be linked to individual products or groups of products, voluntary agreements with manufacturers do not generally imply that a set concentration level will be respected. Rather, voluntary agreements can at best effect a decrease in product emissions. Currently, such emissions reduction is achieved in Germany by including relevant requirements in the criteria documents for award of the Blue Angel to products such as resilient flooring materials, glues, wall paints, and parquet floorings.

Consumer information and education

Consumer information and education does not play a primary role in the setting of guideline values for indoor air. However, a question which could be discussed is whether consumers should be involved in committees addressing the indoor environment. As an example, a representative of the consumer association of North Rhine-Westphalia is among the members of the Indoor Air Hygiene Commission of the Federal Environment Agency.

3.3 Removal of air pollutants by ventilation

The purpose of ventilation is to keep indoor air at a state that meets hygienic requirements with regard to purity, and – depending on the situation – also with regard to humidity and temperature. However, ventilation only has the function of an "aftercare" measure wherever the pollution source has already been installed in the room and remains there.

The type of ventilation is also determined by the type of building or room. While so-called natural ventilation, e.g., opening of windows, air exchange via cracks or stack effects of shafts, is current practice in German homes, office or industrial buildings are frequently equipped with heating, ventilating and air-conditioning (HVAC) systems. However, many intermediate solutions are possible between these extremes.

Given the growing number of rooms built and modified under energy-conservation aspects, appropriate ventilation is increasingly important. Equally, to avoid mould growth in private rooms, care must be taken to ensure sufficient ventilation to eliminate humidity that is increasingly generated in private rooms due to changes in lifestyle (more frequent showering, drying laundry in small rooms).

Legal or other governmental regulation

Legal provisions that have an influence on ventilation aspects are mostly to be found in building law, e.g., in the form of ventilation requirements for bathrooms and toilets without windows. In addition, there are a number of relevant provisions in the laws regarding building design, safety, trade and industry, and clean air, some of which are applicable indirectly. One example is the requirement that there must be sufficient fresh air in enclosed workplaces. Ventilation issues are also touched on by the Energy Saving Act (cf. <http://217.160.60.235/BGBL/bgbl1f/bgbl105s2684.pdf> for the most recent version). Based on provisions contained in the German Civil Code landlords can include conditions in the lease such as the requirement to ventilate regularly.

In Germany, building codes are under the responsibility of the Länder (States). Coordination between the Länder takes place on a voluntary basis within ARGEBAU, a working group of representatives of the Länder ministries responsible for urban development, construction and housing. Inter alia, ARGEBAU develops model laws, ordinances and guidelines which form the basis for the provisions in the building laws issued at Länder level, such as the building codes or the so-called technical building regulations.

Normative standards

A virtually overwhelming number of standards exist for the design, construction, and operation of installations serving ventilation purposes. These standards are updated and enhanced on an ongoing basis.

Of special importance are the HVAC-related standards of the DIN 1946 series, which have “VDI ventilation rules” as a subtitle. The standards developed in Technical Committee 156 “Building Ventilation” of the European Committee on Standardisation (CEN) are called the “new bibles” for HVAC. These ventilation standards have been adopted in Germany as DIN EN 12792 and DIN EN 13779.

Frequently, insufficient maintenance of humidifiers in HVAC systems – especially in office buildings – was found to be the cause of health problems in occupants of such buildings. A successful tool to improve the situation was guideline VDI 6022, prepared a few years ago with the participation of the Federal Environment Agency. This guideline describes, inter alia, the maintenance of HVAC systems. Although not

legally binding, the guideline has quickly been taken up in practice and *de facto* has acquired a certain binding character. The essence of the content of VDI 6022 has been incorporated into the new Workplaces Ordinance of August 2004. In fact, article 3 of this ordinance requires that contamination of HVAC systems which may lead to direct health impairment via indoor air has to be removed promptly.

Voluntary agreements

Voluntary agreements play no role in the area of ventilation.

Consumer information and education

Consumer information and education play an important role for proper ventilation. Consequently, various institutions have published brochures and pamphlets on this topic. Among these institutions, the Federal Environment Agency in recent years has contributed significantly to disseminating relevant knowledge by publishing guides and information brochures. Examples to be mentioned include the so-called school guide, the so-called mould guide, and a brochure on healthy dwellings. Copies of these texts, which can also be downloaded from the Federal Environment Agency's website (www.umweltbundesamt.de), have been requested by the thousands by public institutions, property managers, and the general public. This demonstrates the extent of the need for appropriate objective information.

4. Conclusion

Most of the air that "civilised" people breathe is indoor air. Only rare are the cases in which the concentrations of indoor air pollutants are as high as to give rise to acute, well-defined health effects. Much more frequently, so-called unspecific complaints or annoyances are reported which are thought to be the result of a combined effect of compounds at lower concentration levels. However, even at lower concentration levels, sensitive persons must feel protected from exposure that can be avoided. Protection must be provided by the state and is possible through a number of instruments.

In contrast to the situation for outdoor air, there is currently no comprehensive legislation with regard to indoor air quality. It has to be noted, however, that even in the absence of such comprehensive regulation specifically directed to the indoor environment notable results have already been achieved in improving indoor air quality. Nor would such regulation be appropriate, given the multitude of emission sources which are regulated in laws pertaining to other areas affecting indoor environments, and the private character of most indoor spaces. For building products which are an integral part of the building and cannot be influenced by the occupant, it is envisaged to issue specific provisions based on the AgBB scheme (cf. page 4).

A regulatory gap exists with regard to mandatory product declaration and the guaranty that only low-emission building products and furnishings are installed. In this context it will be possible to draw on information on the effects of substances that should become available through REACH.

Indoor air quality can be further improved by a meaningful combination of the tools described in section 3. The most important among these are specific legal provisions

on emissions limitation in specific cases, an extensive labelling obligation for building products (flooring, wall paper, paints) and furniture covering declaration of their constituents, the preparation of additional normative standards, and consumer information.