

# GREEN BUILDING WITH EMICODE®

LOW-EMISSION PRODUCTS

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# Preface



**Dipl.-Ing. Gerhard Zach**  
President of the Association  
of German Architects (VDA)

**Climate change and an ever changing work environment will result in more and more people spending the majority of their life indoors. Heated during the winter, cooled down in summer – ventilation systems are the norm. Therefore, air quality in buildings is increasingly important.**

Air quality is determined by the emissions from construction components in a building. Green Building in offices and homes will be the state-of-the-art technology with implementation of the passive-house standards.

For building materials this will have consequences: they have to meet very high standards regarding emission characteristics, sustainability, recyclability, durability and must be easy to renovate and to replace. In addition they must be able to be adapted for variable uses: today for office, tomorrow for living purposes.

Thus, in the future, the value of a property will essentially be measured by the cost of the components – either for demolition and disposal or in case of modernisation, renovation or change of use. Each harmful substance has negative effects and results in depreciation. Low polluting and low emission building is therefore future-proof.

For architects, these requirements are hard to meet without neutral, easy to understand and legally watertight guidance. This is where the EMICODE® comes in. It offers guidance and ensures perfect, sustainable, green building and gives reliable information regarding building materials.

The minimum requirements already in place for nurseries and schools, will in the future also be standards for homes and offices.

Therefore, a quality seal such as the EMICODE® is an essential tool for planners to ensure future-proof planning meeting the required standards while at the same time providing legal security. ■



# Contents

## When is a construction material considered sustainable?

When it is produced from safe raw materials? When produced in a resource-efficient manufacturing process? When its durability exceeds that of comparable products or when it can be recycled and re-introduced into the value-creation process?

To date, the absolute sustainability value of a single product is hard to measure. The individual facets of sustainable actions in the industry are

just too diverse. Other issues in the equation are how sustainability and quality of a product interact with each other. Experts know full well that sustainability can only be determined in connection with the intended use of a construction product. For example, a floor covering adhesive significantly adds to the durability of the floor covering and thus makes a valuable contribution to the sustainability of the building. The same applies for parquet.

However, there is one distinguishing criterion which in most cases determines

sustainability irrespective of the intended use: the volume of emissions into the indoor air.

The EMICODE® classifies building materials into three categories based on the volume of emitted organic substances. Therefore, this classification system offers architects and planners, customers and end users as well as contractors safe guidelines for the selection of the right materials for “green building” – and at the same time covers the issue of sustainability. ■

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# What does the EMICODE® offer?

**Environmental certificates are more and more becoming the central factor for buying decisions.**

If a building shall be certified as sustainable after completion of construction, environmental analyses of ingredients and emission characteristics of building products are essential – in fact before they are even installed.

There are different evaluation criteria for “green building” and emission characteristics that play a central role with regard to sustainability rating and healthy living. The criteria established by DGNB (German Sustainable Building Council) for example stipulate that buildings that do not comply with certain minimum requirements for indoor air quality shall not be certified.

An essential parameter for indoor air hygiene is the concentration of harmful volatile organic compounds (VOC), emitted into the air by different materials.

Especially since people tend to spend more and more time indoors, the issue of type and volume of emissions into the air from materials used on walls and floors becomes ever more urgent.

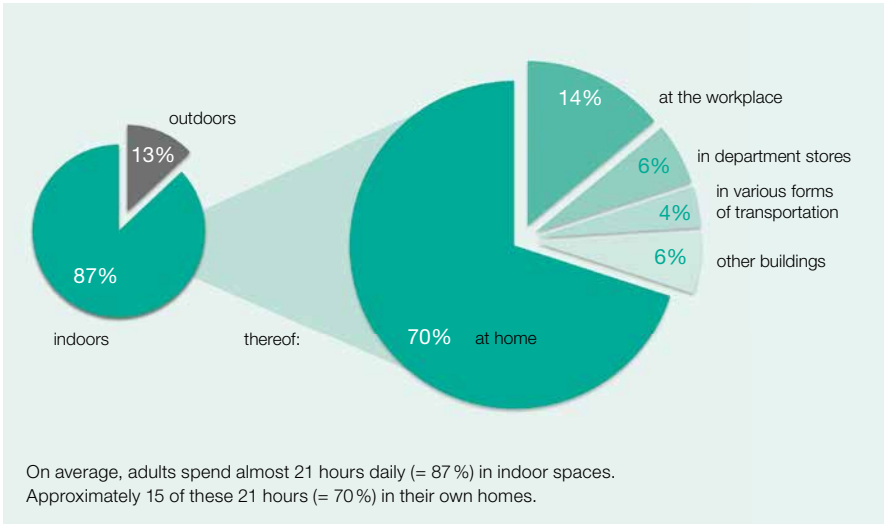
While facades are insulated and window joints nowadays are hermetically sealed, ventilation habits have not kept pace with the technical developments in the area of building shells. Expert recommend a complete exchange of indoor air of approximately 0.8 air changes per hour. In reality, not even half of that rate is achieved (0.36/hour).

In particular emissions from freshly applied varnishes, adhesives, sealing systems and other construction materials may lead to an alarming increase of VOC concentrations in the indoor air even days after installation. For some 20 years already, the EMICODE® offers reliable, safe guidelines for the selection of low emission building products. A protected, competition neutral environmental seal, it classifies installation materials and

building products and certifies them in terms of their emission characteristics – across product, technology and national boundaries.

## In brief

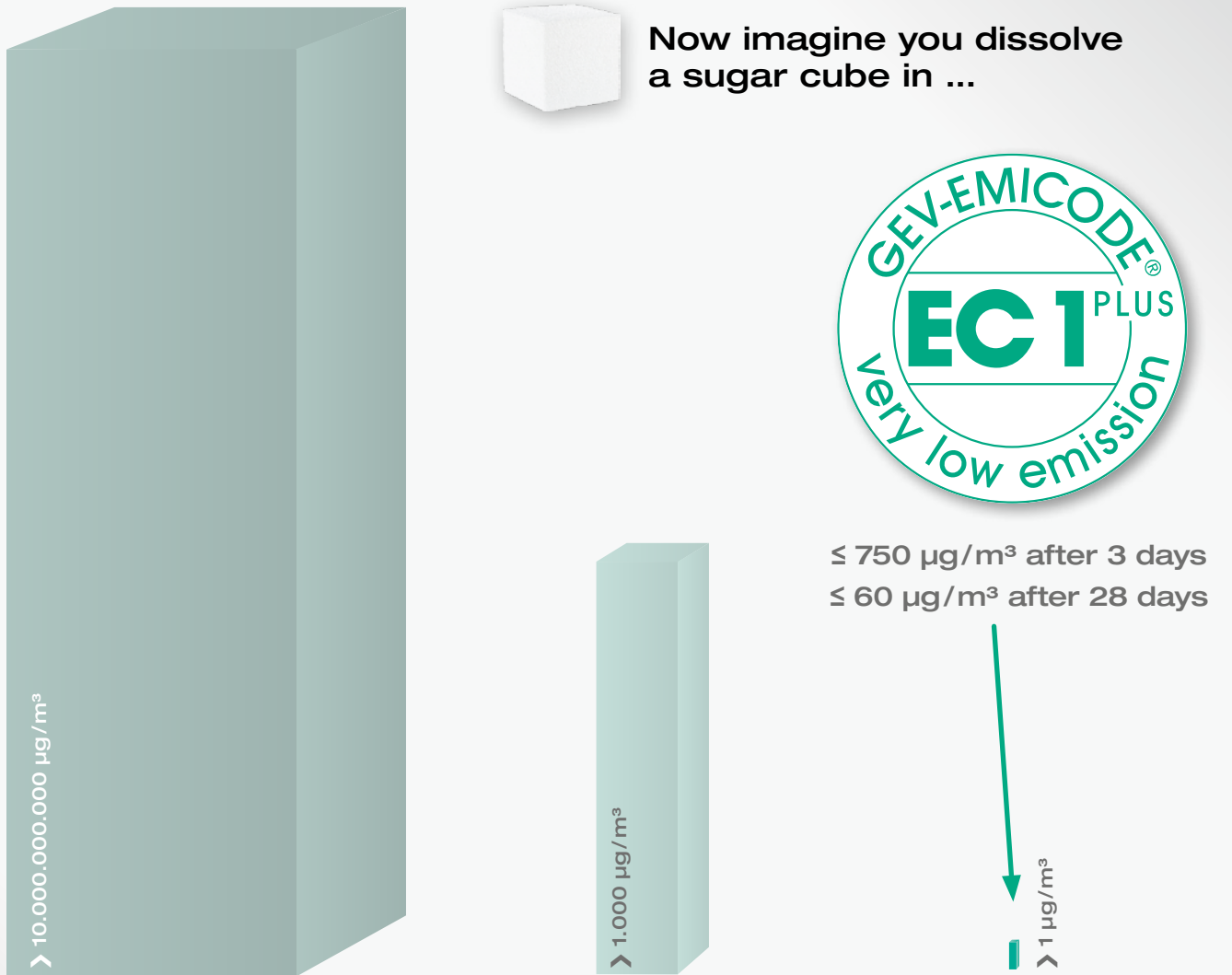
- EMICODE® complies with the requirements for “green building”
- Competition neutral
- Most demanding requirements with regard to VOC emissions
- Essential contribution to healthy living
- Covers a broad range of products
- Recognized internationally
- Safe guideline



Source: Environmental study Federal Environmental Agency (UBA) 1990/92

In everyday life, this is most helpful. No need to compare domestic and international limits and seals. Because: referring to VOC emissions, the EMICODE® premium class “EC 1<sup>PLUS</sup>” imposes the most demanding standards. In addition, the EMICODE® covers the broadest range of construction and auxiliary substances and is the only VOC seal submitting the products to random inspections. Thus, this certification seal offers an important contribution to the environment, healthy living and indoor air hygiene. ■

# That's how low the EC1<sup>Plus</sup> concentration limit is



... a cup of coffee



... a tanker



... a reservoir



The individual fields do not correspond to the real concentration ratios. The proportions can not be exactly displayed in a graph.  
 $1 \mu\text{g}/\text{m}^3 = 0.001 \text{ mg}/\text{m}^3 = 0.000001 \text{ g}/\text{m}^3$

... then the level of emissions of an “EMICODE® EC 1<sup>PLUS</sup>” product after a measurement period of 28 days is comparable to the sugar concentration in a reservoir.

# Three classes, one system

The EMICODE® is a system made up of three categories, exclusively classifying low emission building products based on firmly defined, standardised analyses methods.

The EMICODE® and the associated test procedure were developed by experts from different branches of the construction industry in close dialogue with environmental and consumer protection organisations. The main criterion for classification into the respective EMICODE® class is the volume of emitted volatile organic compounds (VOC). The classification criteria are continually adapted to the current state-of-the-art.

Once a manufacturer applies for certification of one of his products, its emission characteristics are tested by an independent analytical laboratory based on a defined standardized test procedure.

## In brief




- Objective three class evaluation system for low emission building products
- Products are tested by independent, internationally established institutes
- not awarded for products containing solvents (exception: parquet varnishes) or products with CMR\* ingredients
- EMICODE® EC 1<sup>PLUS</sup> is currently the strictest quality label for low emission products

\* CMR: carcinogenic, mutagenic and reprotoxic

Based on the scientifically established data, the manufacturer is awarded the certificate with classification into the respective EMICODE® class. This certificate then entitles him to mark his product with the trademark-protected EMICODE® seal and to promote it accordingly.

Manufacturers whose products bear the EMICODE® undertake to manufacture these products in a quality assured and controlled manner in order to comply with the standards at all times.

In the course of the tests, products are examined for volatile and semi-volatile organic compounds (VOCs). Products containing carcinogenic, mutagenic and reprotoxic substances (CMR substances) are generally never EMICODE® certified. Also excluded are products emitting carcinogenic substances of category 1A and 1B and products containing solvents (boiling point  $< 200^\circ\text{C}$ ; Exception: parquet varnishes up to 5 % or 8 % of solvents).

  				
$\mu\text{g}/\text{m}^3$				
TVOC after 3 days	$\leq$	750	1,000	3,000
TVOC after 28 days	$\leq$	60	100	300
Formaldehyde after 3 days	$\leq$	50	50	50
Acetaldehyde after 3 day	$\leq$	50	50	50
Sum total form- and acetaldehyde after 3 days	$\leq$	0.05 ppm	0.05 ppm	0.05 ppm

$1 \mu\text{g}$  (microgram) =  $0.001 \text{ mg}$  =  $0.000001 \text{ g}$   
TVOC = Total volume of emissions of volatile organic compounds  
For parquet varnishes see [www.emicode.com](http://www.emicode.com)





Photo: Eurofins

# Controlled quality

**Trust is good, control is better! True to this motto, EMICODE® certified products are randomly inspected on a regular basis.**

Without the manufacturers being informed, EMICODE® products are purchased on the free market after a random draw and are then tested by internationally established test institutes for their emission characteristics based on the test method described in the glossary.

Violations are severely penalised. Even technically, they could never be justified, since minimizing the emission characteristics does not necessarily require any compromise regarding functionality or technical quality of the product.

For products violating the advertised EMICODE® properties, manufacturers shall bear the testing costs. In addition, they are obligated to submit for retesting based on the same testing methods all new charges of the product manufactured after remedy of defects in their production process. In case of recurrence, the licence can be revoked and at worst, manufacturers will lose all EMICODE® certification rights. The effect of this sanction is not to be underestimated, since products with the EC 1<sup>PLUS</sup>- or EC 1 label play an important role in the market.

The test results of the last few years clearly show that the discipline to produce optimum qualities is only guaranteed by regular re-examination. To date, EMICODE® is the only VOC label on the market subject to regular strict quality

## In brief

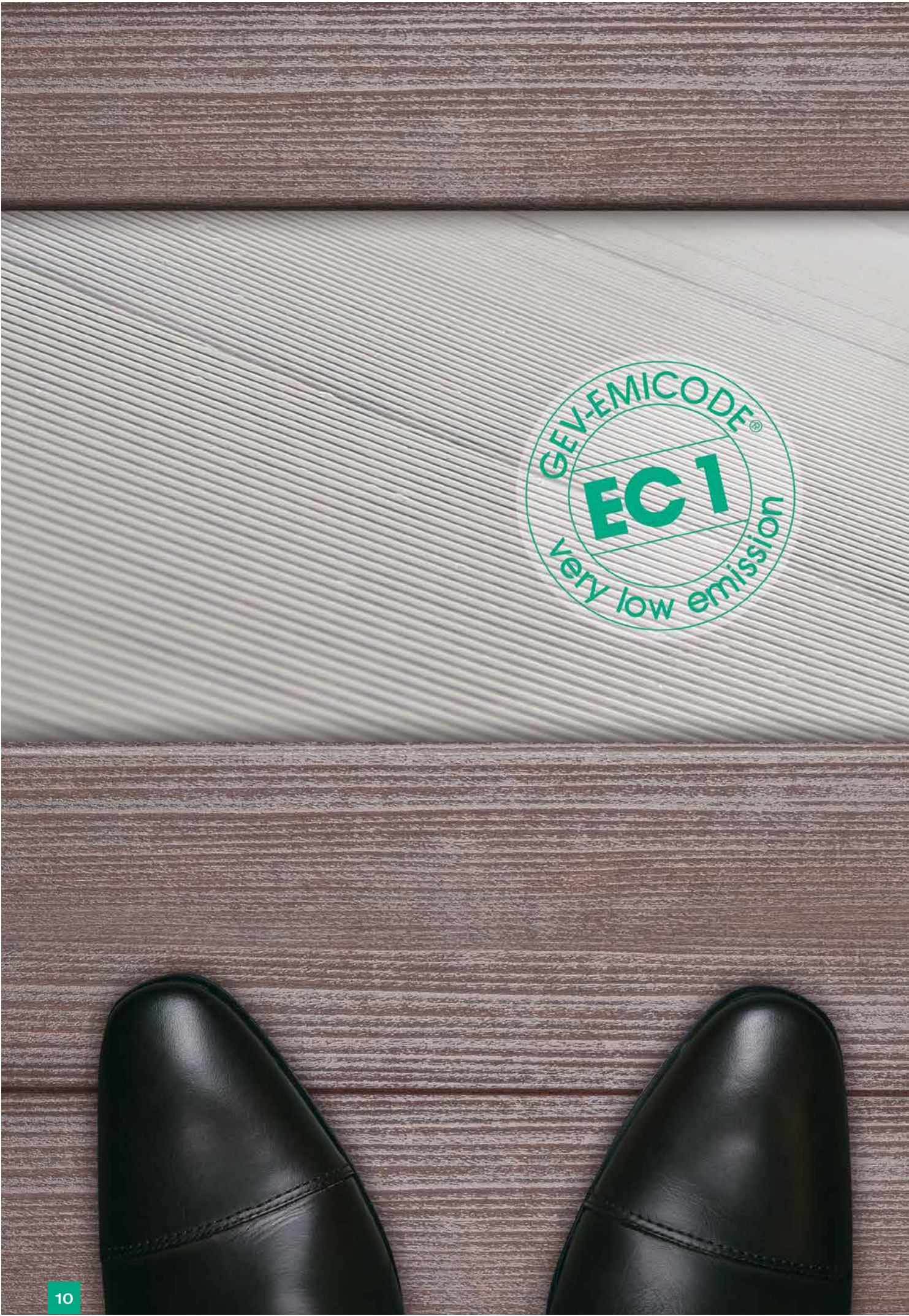
- EMICODE® claims are regularly and randomly examined
- EMICODE® is the only VOC environmental label subject to regular controls
- Violations are severely penalised – even with loss of any type of certification rights

controls and thereby offering the highest possible level of consumer protection regarding indoor air hygiene and healthy living conditions.



Product-related certification license





# EMICODE® – the most exacting VOC environmental seal

**In comparison with all environmental labels, the EMICODE® with its classes EC 1 and EC 1<sup>PLUS</sup> currently sets down the most exacting emission limits in the market.**

This is the conclusion reached by a comparative study conducted by the independent testing institute Eurofins Product Testing A/S.

The scientists at their Galten/ Denmark site specialising in emission measurements had examined the criteria of different environmental

seals – among others also the labels of EMICODE® classes EC 1 and EC 1<sup>PLUS</sup>.

At both times of measurement – after three and then again after 28 days – the EMICODE® guaranteed the lowest TVOC readings. Even class EC 1 and the Blue Angel label with their emission claims are clearly in the top range. Class EC 1<sup>PLUS</sup> is even more ambitious with its claims and requirements. In addition, the EMICODE® statements are continuously and randomly examined.





This is unique in this market and this is how EMICODE® products offer the

### In brief

- Comparative study shows: EMICODE® sets the strictest criteria
- At both measurement points EMICODE® is the front runner and is also randomly controlled and checked

highest level of safety against indoor air contaminants.

### Comparison table national environmental seals

Criterion				
TVOC limit (3d)	< 750 µg/m³	< 1,000 µg/m³	< 1,000 µg/m³	< 10,000 µg/m³
TVOC limit (28d)	< 60 µg/m³	< 100 µg/m³	< 100 µg/m³	< 1,000 µg/m³
Random samples	Lab tests	Lab tests	no tests	no tests

\* Ral 113

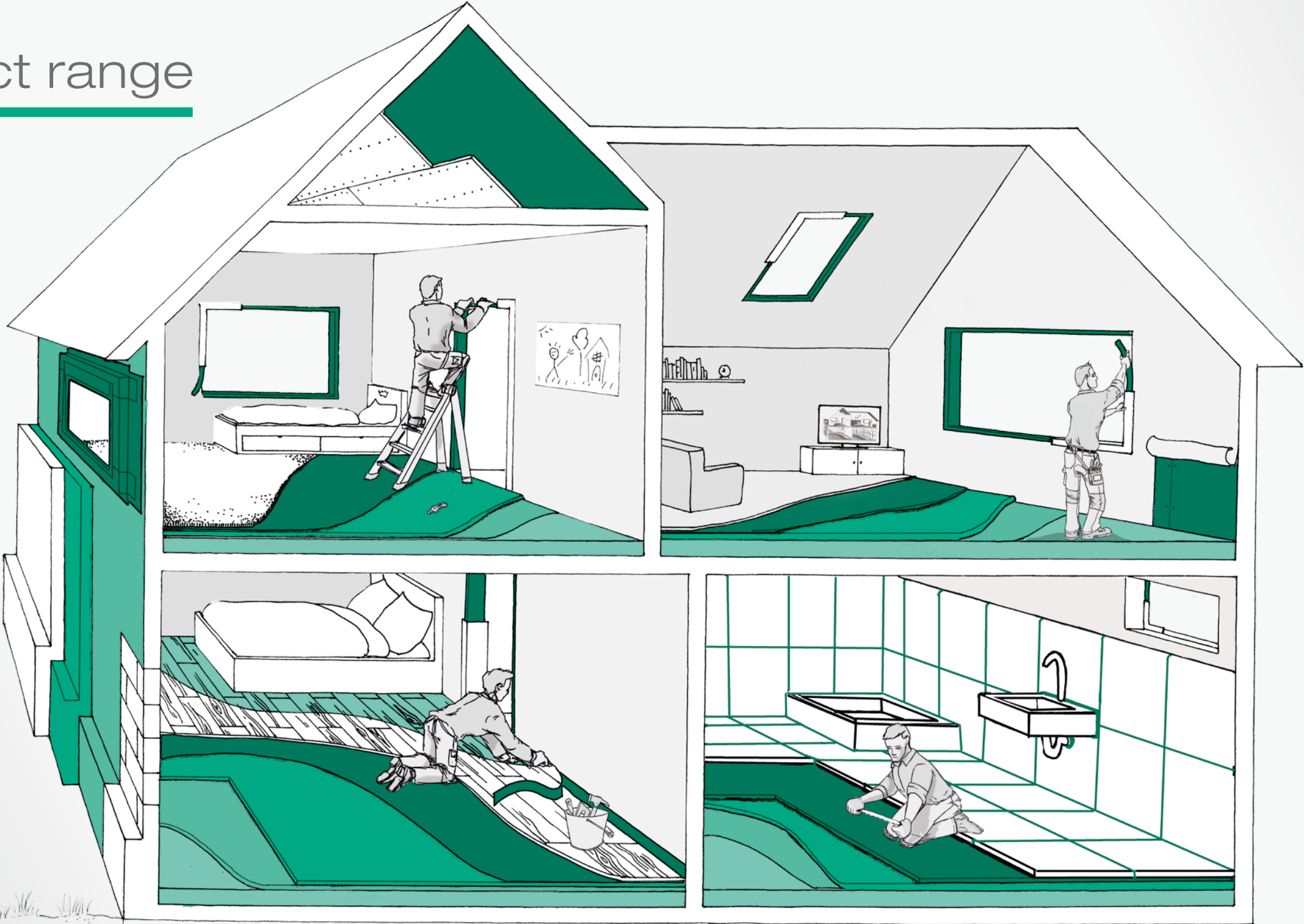


# Product range

## Scope of construction products



Primers	●	●	-
Fillers	●	●	-
Adhesives for floor coverings and parquet	●	●	●
Adhesives and adhesive mortars for tiles	●	-	●
Grouts	●	-	●
Installation underlays, adhesive tapes / films	●	●	●
Surface sealants	●	●	-
Joint sealants	●	●	-
Surface treatment products for parquet	●	●	●
Window sealing systems	●	-	-
Screeds	●	-	-



Initially, EMICODE® was designed with indoor air hygiene for floor installation materials in mind (primers, fillers and floor covering adhesives), but by now, the range has been extended significantly.

Meanwhile, since the demand was there, the EMICODE® evaluation criteria have been adapted to other related branches. In these cases, the EMICODE® for testing, certification and controls was always tailored to the specific aspects of the different building materials and product

categories. Compared to other environmental seals, the EMICODE® for building construction long since covers the broadest range for the evaluation of building chemicals. The latest additions were screeds and screed binders as well as parquet grouts.

The certification system is only expanded after careful consideration and exclusively when manufacturers, processors, planners, architects and consumers alike see an equally significant benefit from evaluation of the product and introduction of the EMICODE®.

**In brief**

- EMICODE® covers the broadest range of products in the building industry
- Upon request, new product groups may be added
- Certification only after careful consideration

\* RAL 113



# Added value

**The following comparison shows the immense influence EMICODE® has had on the quality of indoor air hygiene since its introduction in 1997 – for example:**

while before, the total emission of volatile organic compounds from commercially available solvent-free dispersion adhesives was ~ 10,000 µg/m³, VOC emissions of certified adhesives were not allowed to exceed ≤ 500 µg/m³ according to EMICODE® class “EC 1”, the strictest category at the time. So, in one shot, the emission concentration in indoor spaces was reduced 20 fold.

Another side effect of this development was a significant reduction of complaints which was noted by trade and industry shortly after introduction of the EMICODE® criteria. Up until 2014, in Germany alone approximately 3.6 billion square meters of textile and elastic floor coverings were installed with “EC 1” certified primers, fillers and adhesives – crack resins, underlay sys-

tems and many other products not even included. In addition, there are joint and surface sealants, grouts, window sealing systems and many more products.

## In brief

- VOC emissions decreased 20-fold with introduction of EMICODE®
- At the same time complaints decreased significantly
- Around 4,000 materials are EMICODE®-certified
- More and more manufacturers have their products tested with the EMICODE®-test method

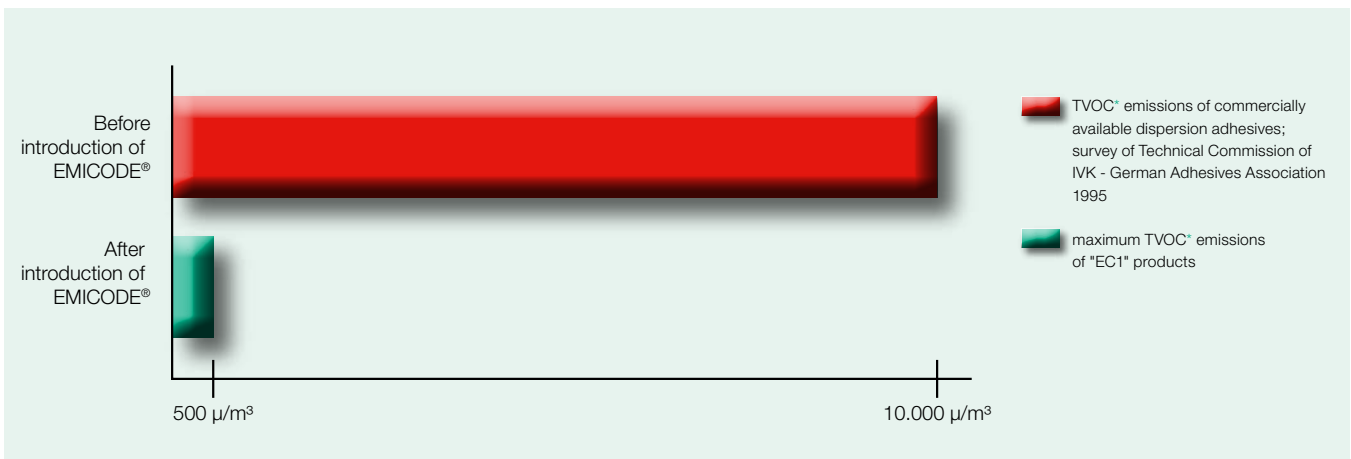
In the meantime, measuring methods have been modernized and emission

standards were raised even further. Nowadays, the VOC limit for products certified as very low in emissions is 100- to 500-fold lower than before 1997 and consequently well below the current maximum limits permitted by law.

Therefore, in craftsmen circles, “EC1” and “EC1<sup>PLUS</sup>” are considered as “the” quality label for low emission building products.

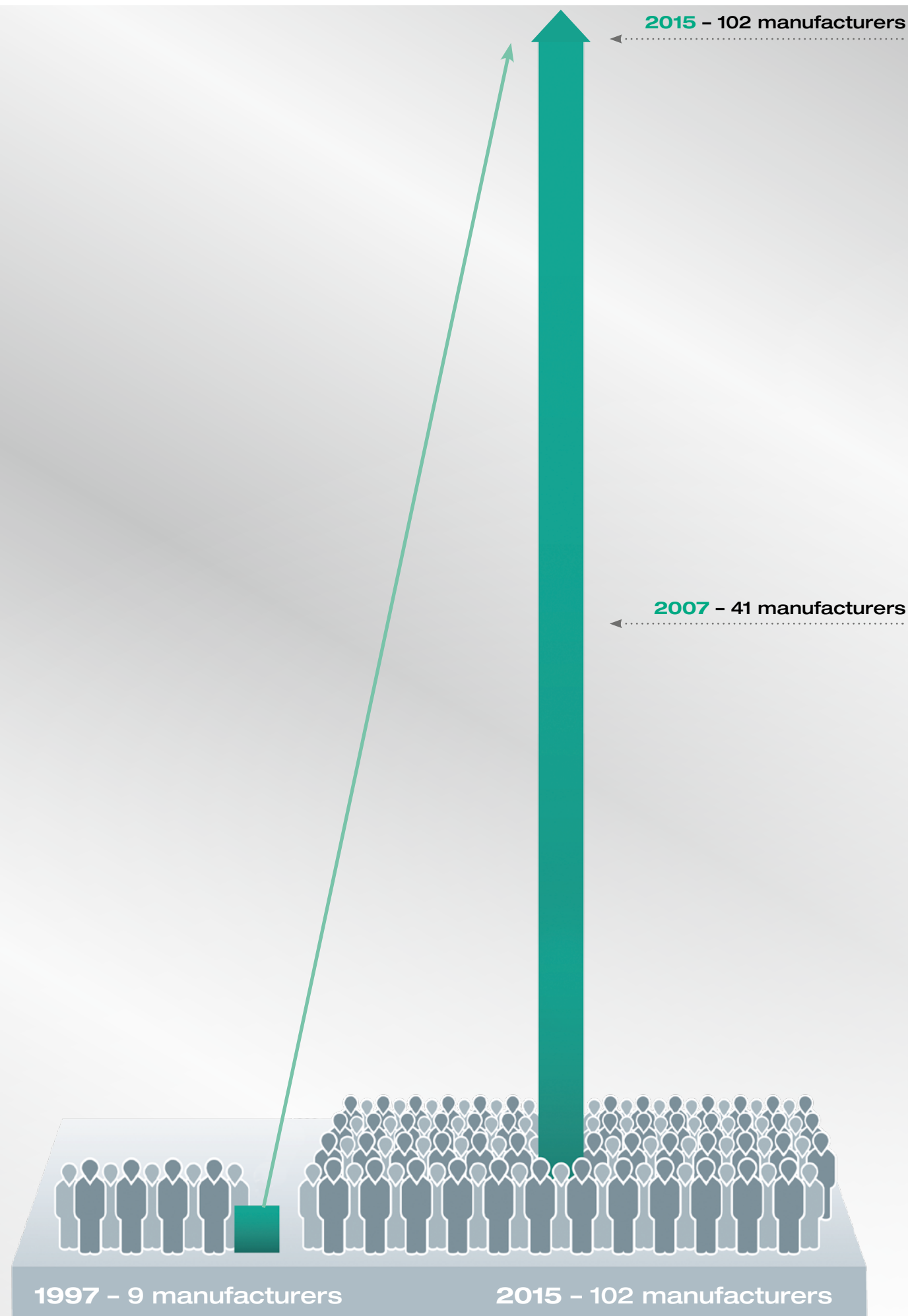
Increasingly, tenders demand the use of at least “EC1” certified installation products. Also on the international level, EMICODE® has become a more and more established standard. By now, many programs for sustainable construction promote the use of “EC1” or “EC1<sup>PLUS</sup>”-certified products: LEED, DGNB, BREEAM.

Around 100 domestic and international manufacturers meanwhile value the EMICODE®. Currently, there are more than 4,000 certified construction products.



\*TVOC = Total Volatile Organic Compounds





Between 2007 and 2015, the number of companies using the EMICODE® has risen by **148.8 percent**.

As of: December 2015

# Committed to the EMICODE®

EMICODE® was launched on the initiative of renowned German adhesive manufacturers with the objective to offer contractors, architects, planners, end consumers and trade better guidance relating to low emission products, systems and technologies available on the market. With the establishment of the current Association for the Control of Emissions in Products for Flooring Installation, Adhesives and Construction Products e.V. (GEV - Gemeinschaft Emissionskontrollierte Verlegewerkstoffe, Klebstoffe und Bauprodukte e.V.) they

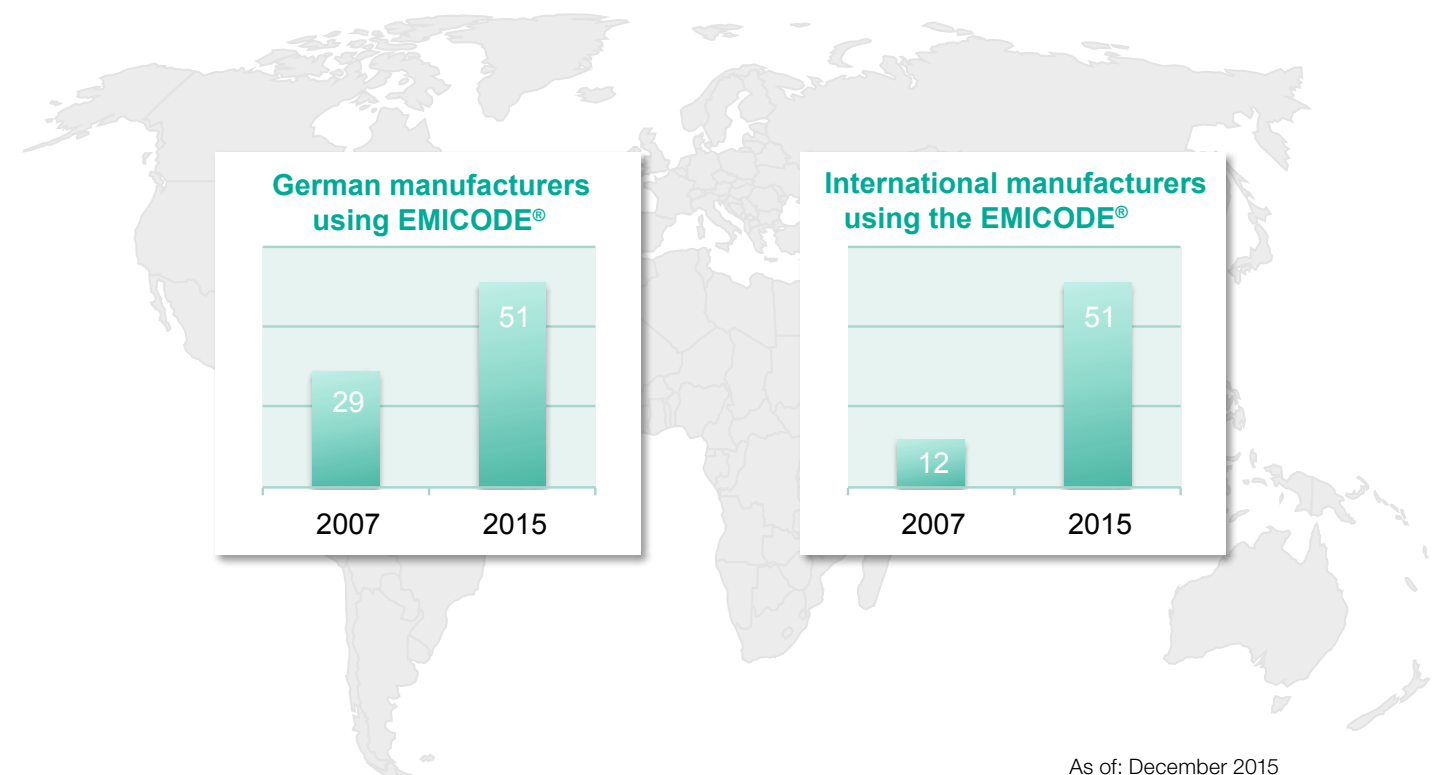
created the related licensing as well as supervisory body.

By now, GEV is an internationally recognized institution which thanks to its function as a market monitor, significantly contributes to consumer, industrial safety and environmental protection. At the same time, EMICODE® has become an international guidance and quality standard for low emission products.

Based on the high trustworthiness of this environmental label and the broad range of participating companies and certified products, more and more domestic and international companies are joining the GEV. Between 2007 and 2014 alone, the membership increased from 41 to more than 100.

## In brief

- GEV: licensing and supervisory body for EMICODE®
- High international acceptance and dissemination
- Membership numbers rising continuously
- More than 100 companies operating nationally and internationally are committed to the GEV and EMICODE®



As of: December 2015



“

On the subject of harmful substances, adhesives with the **EMICODE® EC 1** or better yet the new **EMICODE® EC 1 PLUS** label generate the lowest emissions.

”



1 | 2013,  
Page 124

## What the industry says



### Raw material producer

“The EMICODE® significantly contributed to the fact that all renowned raw material producers have developed environmentally friendly dispersions. Thanks to this development, installation materials have become much more ecological.”

Dr. Maximilian Rüllmann, Technical Marketing Polymer dispersions for construction chemistry at BASF



### BG BAU

“Thanks to the EMICODE®, solvents are definitely on the retreat, also in the development of parquet adhesives. Therefore, EMICODE® indirectly also made an important contribution to the field of industrial safety.”

Dr. Reinhold Rühl, Head of the Central Unit Hazardous Substances at the Occupational Insurance Association of the Construction Industry



### General contractor

“Increasingly, we are confronted with certification criteria according to DGNB (German Sustainable Building Council) or BNB (Evaluation System for Sustainable Building in the Public Sector). In our proposals, we are obligated to list the materials used as well as the raw materials and in some cases even the production methods for these materials. For this reason, industry specific seals such as the EMICODE® take on a growing significance.”

Karl-Peter Arnolds, General Manager of medium-sized nessler-grünzig-gruppe, headquartered in Aachen



### Expert

“EC1 and EC1<sup>PLUS</sup> are so important and have become the leading standard because the criteria originate directly from the industry and specifically deal with installation materials. Statements claiming to be universally valid inevitably will suffer when it comes to quality. In this respect, the EMICODE® not only offers the most reputable and reliable environmental statement for our industry but also a feeling of safety which the contractor can pass on to his customers.”

Richard Kille, publicly appointed and sworn expert for the interior decorating and parquet layer as well as for the floor installing trade.



### Carpet industry

“Even today, selection of a carpet is not necessarily primarily made based on looks and appeal, but also based on its sustainability value. In this context, from the point of view of our industry, the EMICODE® and the EMICODE® EC1<sup>PLUS</sup> class are indispensable standards for sustainable building.”

Peter Schwarzmann, Technical Manager at carpet manufacturer Carpet Concept



### Customer

“For our company, reliable hospital-specific standards are an important reference which result in a competitive advantage. Hence, we as a clinic only use energy saving materials, medical-safe wall paints as well as low emission installation materials. Since the EMICODE® offers the safest emission criteria, we opted for a floor structure with EMICODE® certified products.”

Thomas Stein, Technical Manager St. Marien Hospital Cologne



### Installing company

“As an entrepreneur, I am responsible towards my employees and my customers. This also includes that I make sure I am always up-to-date with state-of-the-art developments on environmental and health issues. Here, the EMICODE® still sets the standard.”

Josef Zagolla, Owner of specialised flooring company Fußbodentechnik Schmitz GmbH in Cologne





## A word or two



**Stefan Neuberger**  
President of GEV

**There are many good ideas floating around, but in the end, few are translated into actions. Fortunately, the EMICODE® was one of the good ideas that was not only implemented but achieved much more than its founders initially planned.**

When technological advances in the 1990s made a radical reduction of volatile organic compounds not only possible but also necessary, manufacturers of floor installation materials were trying to reduce or to eliminate completely the percentage of solvents in their products and to improve the emission characteristics of the products.

At the time, there existed no standards for you as architects and planners, contractors and consumers to offer guidance when looking for low emission primers, fillers and flooring adhesives, let alone safety in the jungle of products on the market. Therefore, the EMICODE® started out as a vision.

It wanted to create transparency, prevent at the root the dissemination of environmental advertising statements which no one could compare and offer guidance for the selection process. The vision has long since become a reality. Nowadays, the EMICODE® is a producer-independent quality and environmental label, established across national borders – a label which is independently supervised and controlled and offers sustainability. It has led to a reduction

of complaints and has become a label which industry and consumers can trust.

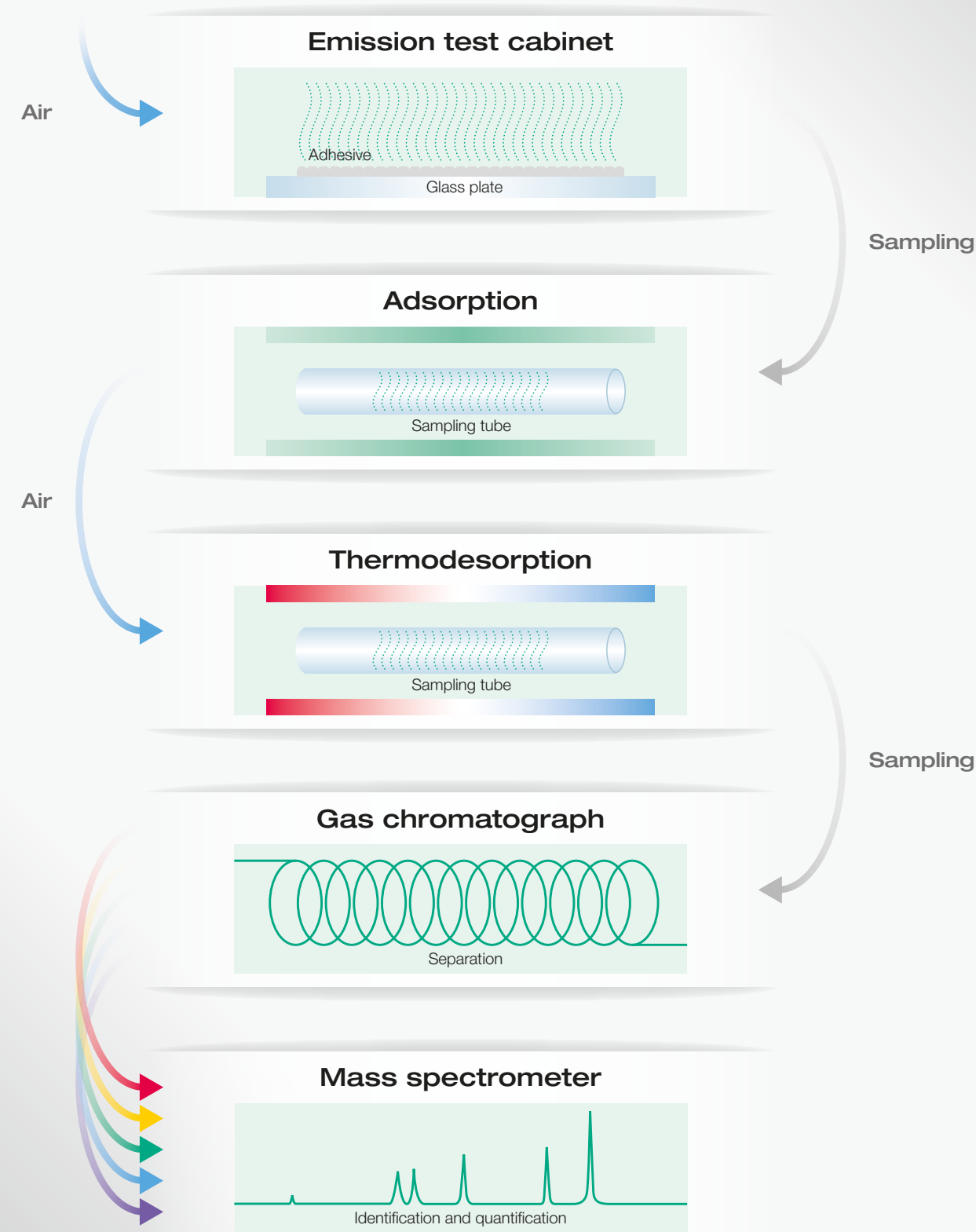
Very quickly, a trend emerged. It became clear: if you wanted to be competitive as a manufacturer of chemical building products, you needed to adapt. This belief unites all those involved in the overall value chain. Raw material suppliers as well as manufacturers of installation products. In their effort to offer products best promoting healthy living, all are pulling together.

The figures speak for themselves. The circle of manufacturers relying on the EMICODE® continuously grows. The range of product categories and technologies is equally expanding at a fast pace. Consequently, the number of EMICODE® certified products constantly increases on the international level. And there is no end in sight. Consumers and contractors as well as you as planners and architects benefit from its significance in the market.

Meanwhile there is hardly any sector in interior construction – whether in new construction or for renovation – for which there are no EMICODE® certified products. On the contrary – these products make their contribution to healthy living and green building everywhere. This enormous presence in the market offers benefits for consumers, contractors and for you as architects and planners. And you can always be sure: when there is the EMICODE® label on the product, you will get EMICODE® standards – today and in the future.



# VOC test method



# Glossary

## EC1<sup>PLUS</sup>

EMICODE® premium class. Products certified with this label offer the lowest possible emission values on the market – in domestic as well as international comparison.

## EMICODE® seal with the added mark “R”

These EMICODE® certificates characterize a special type of product. They designate products particularly low in emissions, but that require protective measures during processing, such as the need for protective gloves or goggles. The “R”, graphically integrated into the seal, stands for “regulated”. This type of labelling is exclusively addressed to installers. For customers or users of the indoor spaces where these products are used, this addition is inconsequential.

## EMICODE®

The EMICODE® is a protected, producer-independent environmental label which classifies and certifies installation and building products according to their emission characteristics based on DIN EN ISO 16000-1 (Indoor air - Part 1: General aspects of sampling strategy) as well as on CEN/prEN 16516, a harmonised testing method developed by the European Committee for Standardization (Assessment of release of dangerous substances from construction products – Determination of emissions in indoor air) and on the standards set by the Technical Committee ISO/TC 146 “Air Quality”.

## Green Building

Once buildings shall be certified as “green”, the question arises as to the evaluation criteria. Nationally, there are for example the criteria set by the DGNB (German Sustainable Building Council) or the evaluation system BNB (Evaluation System for Sustainable Building in the Public Sector) issued by the Federal Ministry of Transport,

Building and Urban Development. On the international level, building classification systems such as LEED or BREEAM can be used as reference. All three promote the use of products certified with EMICODE® “EC1” or “EC1<sup>PLUS</sup>”.

## CMR substances

Carcinogenic, mutagenic and reprotoxic substances.

## Solvents

With the exception of the product group of parquet varnishes, no products containing solvents will be EMICODE® certified. The special regulation is granted since for their production very hard and viscous basic materials are needed to protect the wood from scratches and damages. However, the percentage of solvents may not exceed eight percent for an “EC1” classification. For an “EC1<sup>PLUS</sup>” certification, the maximum limit is five percent.

## Not certified

Products containing carcinogenic, mutagenic and reprotoxic substances (CMR substances) are generally never certified with the EMICODE®. In addition, also carcinogenic substances from categories 1A and 1B shall never be used. Installation products containing solvents (boiling point < 200 °C; exception: parquet varnished up to 5 % or 8 % solvents respectively) are not certified.

## LCI (Lowest Concentrations of Interest) values

The LCI values are the lowest concentrations of interest for indoor spaces from a toxicological standpoint.

## TSVOC

Total Semi-Volatile Organic Compounds

## TVOC

Total Volatile Organic Compounds.

## VOC

Volatile Organic Compounds, according to the WHO definition with a boiling range of 60 to 250 °C.

## VOC testing method (diagram left)

Using highly sensitive analytical methods in laboratories, nowadays even very small traces of volatile organic compounds (VOCs) in the air can be detected and quantified. To this end, independent test laboratories place samples of materials or compound systems in test chambers with a volume of minimum 100 litres under indoor room conditions. Typical low ventilation rates are simulated and then air samples are taken. The emissions collected in the samples are then identified by gas chromatography according to the established CEN/prEN 16516 standard and their volume is determined with a mass spectrometer. In the course of the first sample taking place after three days, the concentrations of the total emissions are determined as TVOCs, volatile aldehydes and carcinogenic substances. From the second air sampling after 28 days, the TVOCs and TSVOCs are measured, the percentage of volatile aldehydes and carcinogenic substances is determined and the emissions are compared to the NIK values. The EMICODE® classification is determined by the level of emissions. VOC concentrations are given in mg/m³ or µg/m³. The testing method is always based on state-of-the-art technology. Most recently, in 2013 the provisions of the new CEN/prEN 16516 standard were integrated into the test procedure. This method serves as the initial test for each licensing application as well as basis for evaluation for each subsequent control test. Only ISO 17025 accredited analysis institutes are commissioned to perform these tests.

## µg/m³:

1 µg/m³ = 0.001 mg/m³ = 0.000001 g/m³.

## Legal Notice

### Contact

Klaus Winkels (Managing Director)  
Tel.: 0211 / 67931-20

Natascha Zapolowski (Assistant)  
Tel.: 0211 / 67931-22

### Photo credits

www.fotolia.de

### Address

GEV – Association for the Control of Emissions in Products for flooring Installation, Adhesives and Building Materials  
RWI-house  
Völklinger Straße 4 · 40219 Düsseldorf  
Postfach 26 01 25 · 40094 Düsseldorf  
Tel.: 0211 / 67931-20 · Fax: 0211 / 67931-33  
info@emicode.com

Managing Director and responsible for the content according to § 6 MDStV (National Agreement on Media Services):  
Klaus Winkels  
Registry Court: District Court Düsseldorf  
Register number: VR 8338

### Concept

Frank Spieß – Die Schnittstelle

### Layout/Production

Team Stiefelhagen Werbeagentur GmbH





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GEV – Association for the Control of Emissions in Products for  
flooring Installation, Adhesives and Building Materials  
Völklinger Straße 4 · 40219 Düsseldorf · Phone +49 (0) 211 6 79 31-22

Fax: +49 (0) 211 6 79 31-33 · E-Mail: [info@emicode.com](mailto:info@emicode.com) · Internet: [www.emicode.com](http://www.emicode.com)