

tremco illbruck Limited
Torrington Avenue
CV4 9TJ Coventry
UK

Test Report No. 53955-001 II

Test objective:	Evaluation according to GEV-EMICODE Classification Criteria
Sample description by client:	Firetherm Intumastic, Nullifire FS702
Sampled by:	Stephen Holles, warrington certification
Date of sampling:	17.07.2018
Location of sampling:	at the client
Date of production:	17.07.2018
Date of arrival of sample:	18.01.2019
Test period:	18.01.2019 - 08.03.2019
Date of report:	11.03.2019
Number of pages of report:	19
Testing laboratory:	eco-INSTITUT Germany GmbH, Köln except ‡ subcontracted # outside accreditation
Test objective fulfilled:	✘

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Sample View

Internal Sample-no.	Description by customer	Condition upon delivery	Type of sample
A001	Firetherm Intumastic, Nullifire FS702	without objection	Fire stopping acrylic sealant



A001: Firetherm Intumastic, Nullifire FS702

Expert Evaluation

The product **Firetherm Intumastic, Nullifire FS702** has been tested on behalf of tremco illbruck Limited.

This evaluation bases on the test criteria “GEV –Requirements for Emission Controlled Installation Products, Adhesives and Building Materials, Award of EMICODE” (Issue: 04.10.2017) of the Association for the Control of Emissions in Products for Flooring Installation, Adhesives and Building Materials (GEV).

The results documented in the test report were evaluated as follows.

Test parameter	Result	Requirement	Requirement hold [yes/no]
Emission analysis			
Measurement time: 3 days after test chamber loading			
Carcinogenic substances (acc. to EU cat. 1A and 1B and TRGS 905, sum)	< 1 µg/m ³	≤ 10 µg/m ³	yes
Formaldehyde	2 µg/m ³	≤ 50 µg/m ³	yes
Acetaldehyde	4 µg/m ³	≤ 50 µg/m ³	yes
Acetaldehyde and Formaldehyde (sum)	0.0038 ppm	≤ 0.05 ppm ¹⁾	yes
Total concentration of volatile organic compounds without acetic acid (TVOC DIN EN 16516) ^{2) 6)}	1800 µg/m ³	≤ 3000 µg/m ^{3 3)}	yes, EC 2
Measurement time: 28 days after test chamber loading			
Carcinogenic substances (acc. to EU cat. 1A and 1B and TRGS 905, sum)	< 1 µg/m ³	≤ 1 µg/m ³	yes
Total concentration of volatile organic compounds without acetic acid (TVOC DIN EN 16516) ^{2) 6)}	340 µg/m ³	≤ 300 µg/m ^{3 3)}	no
Total concentration of semivolatile organic compounds (TVOC DIN EN 16516) ²⁾	< 5 µg/m ³	≤ 40 µg/m ^{3 4)}	yes, EC 1 PLUS
Sum VOC without LCI	5 µg/m ³	≤ 40 µg/m ^{3 5)}	yes
R value	0.40	≤ 1 ⁵⁾	yes

¹⁾ 1 ppm Formaldehyde ≙ 1250 µg/m³ Formaldehyde; 1 ppm Acetaldehyde ≙ 1820 µg/m³ Acetaldehyde

²⁾ for TVOC and TSVOC only substances ≥ 5 µg/m³ are considered

³⁾ requirement value for emission class EMICODE EC 2

⁴⁾ requirement value for emission class EMICODE EC 1 PLUS


⁵⁾ additional requirement value for emission class EMICODE EC 1 PLUS

⁶⁾ Acetic acid is not considered for the evaluation of EMICODE

Summary evaluation

The product **Firetherm Intumastic, Nullifire FS702** does not meet the requirements of the **Emission Class EMICODE EC 2**.

Cologne, 11.03.2019

A handwritten signature in black ink, reading "M.-A. Dobaj". The signature is written in a cursive style with a long, sweeping flourish extending to the right.

Marc-Anton Dobaj, M.Sc. Crystalline Materials
(Project Manager)

Laboratory report

1 Emission analysis

Test method

DIN EN 16516 | Testing and evaluation of the release of dangerous substances; determination of emissions into indoor air

A001, Preparation of test sample

Date: 01.02.2019
Pre-treatment: Filled in aluminium tray; depth: 3 mm; width: 10 mm; transfer into the test chamber immediately after preparation
Masking of backside: not applicable
Masking of edges: yes, 100 %
Relationship of unmasked edges to surface: not applicable
Loading: related to area
Dimensions: 8.75 cm x 1 cm [depth: 3 mm]

A001, Test chamber conditions according to DIN ISO 16000-9

Chamber volume: 0.125 m³
Temperature: 23°C ± 1°C
Relative humidity: 50 % ± 1 %
Air pressure: normal
Air: cleaned
Air change rate: 0.5 h⁻¹
Air velocity: 0.3 m/s
Loading: 0.007 m²/m³
Specific air flow rate: 71.4 m³/(m² · h)
Air sampling: 3 days after test chamber loading
28 days after test chamber loading

Analytcs

Aldehydes and Ketones | DIN ISO 16000-3
Limit of determination: 2 µg/m³
Volatile Organic Compounds | DIN ISO 16000-6
Limit of determination: 1 µg/m³ (1,4-Cyclohexanedimethanol, Diethylene glycol, 1,4-Butanediol, Linalyl acetate: 5 µg/m³)
Note for analysis: not specified

1.1 Sample A001, Volatile Organic Compounds after 3 days

Test objective:

Volatile Organic Compounds (VOC), test chamber, air sampling 3 days after test chamber loading

Test result:

Sample: A001: Firetherm Intumastic, Nullifire FS702

No.	Substance	CAS No.	RT [min]	Concentration+ Substances ≥ 1 µg/m³ [µg/m³]	Toluene- equivalent Substances ≥ 5 µg/m³ [µg/m³]	CMR Classifi- cation++	LCI AgBB 2018 [µg/m³]	R- value
2	Aliphatic hydrocarbons (n-, iso- and cyclo-)							
2-10.3	n-Undecane	1120-21-4	14.75	7	9		6000	0.00
2-10.6	n-Tetradecane	629-59-4	21.38	1			6000	0.00
4	Aliphatic mono alcohols (n-, iso-, cyclo-) and dialcohols							
4-6	1-Butanol	71-36-3	5.56	6			3000	0.00
4-10	2-Ethyl-1-hexanol	104-76-7	13.28	35	30		300	0.12
6	Glycols, Glycol ethers, Glycol esters							
6-5	Diethylene glycol- monobutylether	112-34-5	17.36	200	180		670	0.30
6-11	Diethylene glycol monomethyl ether acetate (2-(2-Butoxyethoxy) ethyl acetate) (BDGA)	124-17-4	21.24	650	720		850	0.76
6-12	Dipropylene glycol monomethyl ether	34590-94-8	13.19	810	810		3100	0.26
6-39	Dipropylene glycol dimethyl ether	111109-77- 4	17.74+13.17	7	7		1300	0.01
7	Aldehyde							
7-20	Acetaldehyde	75-07-0		4		Carc. 2	1200	0.00
7-22	Formaldehyde	50-00-0		2		Carc. 1B Muta. 2	100	0.02
8	Ketones							
8-10	Acetone	67-64-1		3			1200	0.00
9	Acids							
9-1	Acetic acid	64-19-7	4.35	7			1200	0.01

Remark: The test result referred to the submitted test sample exclusively. The validity of the report is three years at most and will end immediately at any alternation of material composition or in manufacturing process. Publishing in parts requires authorisation.

No.	Substance	CAS No.	RT [min]	Concentration+	Toluene-equivalent	CMR Classifi- cation++	LCI	R- value
				Substances ≥ 1 µg/m³ [µg/m³]	Substances ≥ 5 µg/m³ [µg/m³]		AgBB 2018 [µg/m³]	
10	Esters							
10-2	Ethyl acetate	141-78-6	4.84	2				
10-11	1 Butyl acetate	123-86-4	8.37	2			4800	0.00
10-15	n-Butyl acrylate	141-32-2	10.22	1		Group 3	110	0.01
13	Other identified substances in addition to LCI list							
	Hexamethylcyclotrisiloxane (D3)	541-05-9	8.21	2				
2-10	Cluster isoalkanes, alkenes and/or other alcohols*	--	8.70	15	15		6000	0.00
	Acetamide	60-35-5	7.30	4		Carc. 2		
	m/z 43 61 70*		4.84	1				
	Butyl ether m/z 57 41 87*		9.94	3				
	several not identified substances*		15.4-16.5	25	25			
	m/z 55 99 135*		18.20	3				

+ identified and calibrated substances, substance specific calculated

++ Classification according to Regulation (EG) N° 1272/2008: Categories Carc. 1A and 1B, Muta. 1A and 1B, Repr. 1A and 1B, TRGS 905: K1A, K1B, M1A, M1B, R1A, R1B; IARC: Group 1 and 2A, DFG MAK-list: Kategorie III1 and III2

* unidentified substances, calculated as toluene equivalent reported with significant mass fragments as mass-to-charge ratio (m/z)

Carcinogenic, mutagenic and reproductive toxic components*	Concentration after 3 days [µg/m³]	SERa [µg/(m² · h)]
CMR 1: VOC (incl. VVOC and SVOC) with the following categorisations: Regulation (EC) No. 1272/2008: Category Carc. 1A and 1B, Muta. 1A and 1B, Repr. 1A and 1B; TRGS 905: K1A, K1B, M1A, M1B, R1A, R1B; IARC: Group 1 and 2A; DFG (MAK list): Categories III1, III2 (Sum)	< 1	< 71.43
C 1: VOC (incl. VVOC and SVOC) with the following categorisations: Regulation (EG) Nr. 1272/2008: Category Carc. 1A u. 1B (Sum)	< 1	< 71.43

TVOC, Total volatile organic compounds	Concentration after 3 days [µg/m³]	SERa [µg/(m² · h)]
Sum of VOC according to DIN EN 16516	1800	130000
Sum of VOC according to AgBB 2018 / DIBt	1800	130000
Sum of VOC according to eco-INSTITUT-Label	1800	130000
Sum of VOC according to ISO 16000-6	1900	140000

TSVOC, Total semi volatile organic compounds	Concentration after 3 days [µg/m³]	SERa [µg/(m² · h)]
Sum of SVOC according to DIN EN 16516	< 5	< 357.15
Sum of SVOC without LCI according to AgBB 2018 / DIBt	< 5	< 357.15
Sum of SVOC without LCI according to eco-INSTITUT-Label	< 1	< 71.43
Sum of SVOC with LCI according to AgBB 2018 / DIBt	< 5	< 357.15

TVVOC, Total very volatile organic compounds	Concentration after 3 days [µg/m³]	SERa [µg/(m² · h)]
Sum of VVOC according to AgBB 2018 / DIBt and Belgian regulation	< 5	< 357.15
Sum of VVOC according to eco-INSTITUT-Label	11	790

*Excluding formaldehyde (Carc. 1B) due to an assumed "practical threshold" under which a significant carcinogenic risk is no longer to be expected (see Federal Institute for Risk Assessment (2006): Toxicological evaluation of formaldehyde and Federal Environment Agency (2016): Reference value for formaldehyde in indoor air). In the case of a toxicological emission assessment, a single-substance analysis of the formaldehyde concentration is necessary. In the opinion of the committee for Indoor Air Guide Values (Ausschuss für Innenraumrichtwerte) of the Federal Environment Agency, the concentration of 0.1 mg formaldehyde/m³ indoor air, based on a measurement period of half an hour, should not be exceeded, also for a short time (Bundesgesundheitsblatt 2016 · 59: 1040-1044 DOI 10.1007 / s00103 - 016-2389-5 © Springer-Verlag Berlin Heidelberg 2016).

Remark: The test result referred to the submitted test sample exclusively. The validity of the report is three years at most and will end immediately at any alternation of material composition or in manufacturing process. Publishing in parts requires authorisation.

Other sums of VOC	Concentration after 3 days [µg/m³]	SERa [µg/(m² · h)]
VOC without LCI according to AgBB/DIBt and Belgian regulation (Sum)	25	1800
VOC without LCI according to eco-INSTITUT-Label (Sum)	38	2700
CMR 2: VOC (incl. VVOC and SVOC) with the following categorisations: Regulation (EC) No. 1272/2008: Category Carc. 2, Muta. 2, Repr. 2; TRGS 905: K3; IARC: Group 2B; DFG (MAK list): Category III3 (Sum)	10	710
Sensitising compounds with the following categorisations: DFG (MAK list): Category IV, German Federal Institute for Risk Assessment lists: Cat A, TRGS 907 (Sum)	3	210
Bicyclic Terpenes (sum)	< 1	< 71.43
C9 - C14: Alkanes / Isoalkanes as dekane-equivalent (Sum)	9	640
C4 - C11 Aldehydes, acyclic, aliphatic (Sum)	< 2	< 142.86
C9 - C15 Alkylated benzenes (Sum)	< 1	< 71.43
Cresols (Sum)	< 1	< 71.43

Risk value for assessment of LCI	R-value
R-value according to eco-INSTITUT-Label	1.49
R-value according to AgBB 2018 / DIBt	1.46
R-value according to Belgian regulation	1.46
R-value according to AFSSET	1.40

Note:

Due to different requirements in the respective guidelines, the calculation of TVOC, TVVOC, TSVOC and R-value may result in different values.

For short-chain carbonyl compounds (C₁-C₅), which are quantified by HPLC according to DIN ISO 16000-3, no indication of the toluene equivalent is specified. Therefore, these substances are considered with their substance-specific Quantification in the TVVOC acc. DIN EN 16516.

Remark: The test result referred to the submitted test sample exclusively. The validity of the report is three years at most and will end immediately at any alternation of material composition or in manufacturing process. Publishing in parts requires authorisation.

1.2 Sample A001, Volatile Organic Compounds after 28 days

Test objective:

Volatile Organic Compounds (VOC), test chamber, air sampling 28 days after test chamber loading

Test result:

Sample: A001: Firetherm Intumastic, Nullifire FS702

No.	Substance	CAS No.	RT [min]	Concentration+ Substances ≥ 1 µg/m³ [µg/m³]	Toluene- equivalent Substances ≥ 5 µg/m³ [µg/m³]	CMR Classifi- cation++	LCI AgBB 2018 [µg/m³]	R- value
6	Glycols, Glycol ethers, Glycol esters							
6-5	Diethylene glycol- monobutylether	112-34-5	17.41	32	28		670	0.05
6-11	Diethylene glycol monomethyl ether acetate (2-(2-Butoxyethoxy) ethyl acetate) (BDGA)	124-17-4	21.39	290	290		850	0.34
6-12	Dipropylene glycol monomethyl ether	34590-94-8	13.25	23	21		3100	0.01
7	Aldehyde							
7-22	Formaldehyde	50-00-0		3		Carc. 1B Muta. 2	100	0.03
8	Ketones							
8-10	Acetone	67-64-1		2			1200	0.00
9	Acids							
9-1	Acetic acid	64-19-7	4.85	10			1200	0.01
13	Other identified substances in addition to LCI list							
	Hexamethylcyclotrisiloxane (D3)	541-05-9	8.92	3				
	several not identified substances*		16.17- 17.25	5	5			

+ identified and calibrated substances, substance specific calculated

++ Classification according to Regulation (EG) N° 1272/2008: Categories Carc. 1A and 1B, Muta. 1A and 1B, Repr. 1A and 1B, TRGS 905: K1A, K1B, M1A, M1B, R1A, R1B; IARC: Group 1 and 2A, DFG MAK-list: Kategorie III1 and III2

* unidentified substances, calculated as toluene equivalent reported with significant mass fragments as mass-to-charge ratio (m/z)

Remark: The test result referred to the submitted test sample exclusively. The validity of the report is three years at most and will end immediately at any alternation of material composition or in manufacturing process. Publishing in parts requires authorisation.

Carcinogenic, mutagenic and reproductive toxic components*	Concentration after 28 days [µg/m³]	SERa [µg/(m² · h)]
CMR 1: VOC (incl. VVOC and SVOC) with the following categorisations: Regulation (EC) No. 1272/2008: Category Carc. 1A and 1B, Muta. 1A and 1B, Repr. 1A and 1B; TRGS 905: K1A, K1B, M1A, M1B, R1A, R1B; IARC: Group 1 and 2A; DFG (MAK list): Categories III1, III2 (Sum)	< 1	< 71.43
C 1: VOC (incl. VVOC and SVOC) with the following categorisations: Regulation (EG) Nr. 1272/2008: Category Carc. 1A u. 1B (Sum)	< 1	< 71.43

TVOC, Total volatile organic compounds	Concentration after 28 days [µg/m³]	SERa [µg/(m² · h)]
Sum of VOC according to DIN EN 16516	340	25000
Sum of VOC according to AgBB 2018 / DIBt	360	26000
Sum of VOC according to eco-INSTITUT-Label	360	26000
Sum of VOC according to ISO 16000-6	370	26000

TSVOC, Total semi volatile organic compounds	Concentration after 28 days [µg/m³]	SERa [µg/(m² · h)]
Sum of SVOC according to DIN EN 16516	< 5	< 357.15
Sum of SVOC without LCI according to AgBB 2018 / DIBt	< 5	< 357.15
Sum of SVOC without LCI according to eco-INSTITUT-Label	< 1	< 71.43
Sum of SVOC with LCI according to AgBB 2018 / DIBt	< 5	< 357.15

TVVOC, Total very volatile organic compounds	Concentration after 28 days [µg/m³]	SERa [µg/(m² · h)]
Sum of VVOC according to AgBB 2018 / DIBt and Belgian regulation	< 5	< 357.15
Sum of VVOC according to eco-INSTITUT-Label	5	360

*Excluding formaldehyde (Carc. 1B) due to an assumed "practical threshold" under which a significant carcinogenic risk is no longer to be expected (see Federal Institute for Risk Assessment (2006): Toxicological evaluation of formaldehyde and Federal Environment Agency (2016): Reference value for formaldehyde in indoor air). In the case of a toxicological emission assessment, a single-substance analysis of the formaldehyde concentration is necessary. In the opinion of the committee for Indoor Air Guide Values (Ausschuss für Innenraumrichtwerte) of the Federal Environment Agency, the concentration of 0.1 mg formaldehyde/m³ indoor air, based on a measurement period of half an hour, should not be exceeded, also for a short time (Bundesgesundheitsblatt 2016 · 59: 1040-1044 DOI 10.1007 / s00103 - 016-2389-5 © Springer-Verlag Berlin Heidelberg 2016).

Remark: The test result referred to the submitted test sample exclusively. The validity of the report is three years at most and will end immediately at any alternation of material composition or in manufacturing process. Publishing in parts requires authorisation.

Other sums of VOC	Concentration after 28 days [µg/m³]	SERa [µg/(m² · h)]
VOC without LCI according to AgBB/DIBt and Belgian regulation (Sum)	5	360
VOC without LCI according to eco-INSTITUT-Label (Sum)	8	570
CMR 2: VOC (incl. VVOC and SVOC) with the following categorisations: Regulation (EC) No. 1272/2008: Category Carc. 2, Muta. 2, Repr. 2; TRGS 905: K3; IARC: Group 2B; DFG (MAK list): Category III3 (Sum)	3	210
Sensitising compounds with the following categorisations: DFG (MAK list): Category IV, German Federal Institute for Risk Assessment lists: Cat A, TRGS 907 (Sum)	3	210
Bicyclic Terpenes	< 1	< 71.43
C9 - C14: Alkanes / Isoalkanes as dekane-equivalent (Sum)	< 1	< 71.43
C4 - C11 Aldehydes, acyclic, aliphatic (Sum)	< 2	< 142.86
C9 - C15 Alkylated benzenes (Sum)	< 1	< 71.43
Cresols (Sum)	< 1	< 71.43

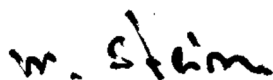
Risk value for assessment of LCI	R-value
R-value according to eco-INSTITUT-Label	0.44
R-value according to AgBB 2018 / DIBt	0.41
R-value according to Belgian regulation	0.41
R-value according to AFSSET	0.44

Note:

Due to different requirements in the respective guidelines, the calculation of TVOC, TVVOC, TSVOC and R-value may result in different values.

For short-chain carbonyl compounds (C₁-C₅), which are quantified by HPLC according to DIN ISO 16000-3, no indication of the toluene equivalent is specified. Therefore, these substances are considered with their substance-specific Quantification in the TVVOC acc. DIN EN 16516.

Cologne, 11.03.2019



Michael Stein, Dipl.-Chem.
 (Laboratory Manager)

Remark: The test result referred to the submitted test sample exclusively. The validity of the report is three years at most and will end immediately at any alternation of material composition or in manufacturing process. Publishing in parts requires authorisation.

II Definition of terms

VOC (volatile organic compounds)	All individual compounds with a concentration $\geq 1 \mu\text{g}/\text{m}^3$ in the retention range C ₆ (n-Hexane) to C ₁₆ (n-Hexadecane)
TVOC	Total volatile organic compounds
TVOC according to DIN EN 16516	Sum of all VOC $\geq 5 \mu\text{g}/\text{m}^3$ in the retention range C ₆ to C ₁₆ , calculated as toluene equivalent
TVOC according to AgBB/DIBt	Sum of all identified and calibrated VOC $\geq 5 \mu\text{g}/\text{m}^3$, SVOC $\geq 5 \mu\text{g}/\text{m}^3$ with LCI and not calibrated VOC $\geq 5 \mu\text{g}/\text{m}^3$ calculated as toluene equivalent
TVOC according to eco-INSTITUT-Label	Sum of all identified and calibrated VOC $\geq 1 \mu\text{g}/\text{m}^3$, SVOC $\geq 5 \mu\text{g}/\text{m}^3$ with LCI and not calibrated VOC $\geq 1 \mu\text{g}/\text{m}^3$ calculated as toluene equivalent
TVOC according to ISO 16000-6	Total area of chromatogram in the retention range C ₆ to C ₁₆ , calculated as toluene equivalent
TVOC without LCI according to AgBB/DIBt and Belgian regulation	Sum of all VOC without NIK $\geq 5 \mu\text{g}/\text{m}^3$ in the retention range C ₆ to C ₁₆
TVOC without LCI according to eco-INSTITUT-Label	Sum of all VOC without NIK $\geq 1 \mu\text{g}/\text{m}^3$ in the retention range C ₆ to C ₁₆
CMR-VOC (carcinogenic, mutagenic, reproduction-toxic VOC, VVOC and SVOC)	All individual substances with the following categories: Regulation (EC) No. 1272/2008: Category Car.1A and 1B, Muta. 1A and 1B, Repr. 1A and 1B TRGS 905: K1A, K1B, M1A, M1B, R1A, R1B IARC: Group 1 and 2A DFG (MAK lists): Category III1 and III2
VVOC (very volatile organic compounds)	All individual substances with a concentration $\geq 1 \mu\text{g}/\text{m}^3$ in the retention range $< C_6$
TVVOC	Total very volatile organic compounds
TVVOC according to AgBB/DIBt and Belgian regulation	Sum of all identified and calibrated VVOC $\geq 5 \mu\text{g}/\text{m}^3$ with LCI
TVVOC according to eco-INSTITUT-Label	Sum of all identified and calibrated VVOC $\geq 1 \mu\text{g}/\text{m}^3$ with LCI
SVOC (semi volatile organic compounds)	All individual substances $\geq 1 \mu\text{g}/\text{m}^3$ in the retention range C ₁₆ to C ₂₂
TSVOC	Total semi volatile organic compounds
TSVOC according to DIN EN 16516	Sum of all SVOC in the retention range C ₁₆ to C ₂₂ , calculated as toluene equivalent
TSVOC without LCI according to AgBB/DIBt	Sum of all SVOC $\geq 5 \mu\text{g}/\text{m}^3$ without LCI
TSVOC without LCI according to eco-INSTITUT-Label	Sum of all SVOC $\geq 1 \mu\text{g}/\text{m}^3$ without LCI
TSVOC with LCI according to AgBB/DIBt	Sum of all identified and calibrated SVOC $\geq 5 \mu\text{g}/\text{m}^3$ with LCI
SER	Specific emission rate (see appendix IV)

LCI value	Lowest Concentration of Interest; calculated value for the evaluation of VOC, established by the Committee for Health-related Evaluation of Building Products (Ausschuss zur gesundheitlichen Bewertung von Bauprodukten - AgBB)
R value	The quotient of the concentration and the LCI value is generated for every substance which is detected in the test chamber air. The sum of the calculated quotients results in the R value.
R value according to eco-INSTITUT-Label	R value for all identified and calibrated VOC $\geq 1 \mu\text{g}/\text{m}^3$ with LCI, established by the AgBB in 2018
R value according to AgBB 2018/DIBt	R value for all identified and calibrated VOC $\geq 5 \mu\text{g}/\text{m}^3$ with LCI, established by the AgBB in 2018
R value according to Belgian regulation	R value for all identified and calibrated VOC $\geq 5 \mu\text{g}/\text{m}^3$ with LCI, established by the Belgian regulation
R value according to AFSSET	R value for all identified and calibrated VOC $\geq 5 \mu\text{g}/\text{m}^3$ with LCI, established by ANSES (French National Agency on Food Safety, Environment, and Workplace Security)
RT (retention time)	Time for a particular analyte to pass through the system (from the column inlet to the detector)
CAS No. (Chemical Abstracts Service)	International unique numerical identifier for a chemical substance
Toluene equivalent	Concentration, calculated as toluene equivalent

III List of calibrated Volatile Organic Compounds (VOC)

Aromatic hydrocarbons

Toluene
Ethylbenzene
p-Xylene
m-Xylene
o-Xylene
Isopropylbenzene
n-Propylbenzene
1,3,5-Trimethylbenzene
1,2,4-Trimethylbenzene
1,2,3-Trimethylbenzene
2-Ethyltoluene
1-Isopropyl-2-methylbenzene
1-Isopropyl-4-methylbenzene
1,2,4,5-Tetramethylbenzene
n-Butylbenzene
1,3-Diisopropylbenzene
1,4-Diisopropylbenzene
Phenyltoluene
1-Phenyldecane²
1-Phenylundecane²
4-Phenylcyclohexene
Styrene
β-Methylstyrene
Phenylacetylene
2-Phenylpropene
Vinyltoluene
Naphthalene
Indene
Benzene
1-Methylnaphthalene
2-Methylnaphthalene
1,4-Dimethylnaphthalene

Saturated aliphatic substances

2-Methylpentane¹
3-Methylpentane¹
n-Hexane
Cyclohexane
Methylcyclohexane
n-Heptane
n-Octane
n-Nonane
n-Decane
n-Undecane
n-Dodecane
n-Tridecane
n-Tetradecane
n-Pentadecane
n-Hexadecane
Methylcyclopentane
1,4-Dimethylcyclohexane
2,2,4,6,6-Pentamethylheptane

Terpenes

δ-3-Carene
α-Pinene
β-Pinene
Limonene
Longifolene

β-Caryophyllene
α-Phellandrene
Myrcene
Camphene
α-Terpinene
Longipinene
trans-β-Farnesene
cis-β-Farnesene
Isolongifolene

Aliphatic alcohols and ether

1-Propanol¹
2-Propanol¹
1-Butanol
1-Pentanol
1-Hexanol
tert-Butanol
Cyclohexanol
2-Ethyl-1-hexanol
2-Methyl-1-propanol
1-Octanol
4-Hydroxy-4-methyl-2-pentanone
1-Heptanol
1-Nonanol
1-Decanol
1,4-Cyclohexandimethanol

Aromatic alcohols (phenoles)

Phenol
BHT (2,6-Di-tert-butyl-4-methylphenol)
Benzyl alcohol
Cresols

Glycols, Glycol ether, Glycol ester

Propylenglycol (1,2-Dihydroxypropane)
Ethylene glycol (Ethandiol)
Ethylene glycol monobutyl ether
Diethylene glycol
Diethylene glycol-monobutyl ether
2-Phenoxyethanol
Ethylene carbonate
1-Methoxy-2-propanol
2-Methoxy-1-propanol
2-Methoxy-1-propyl acetate
Texanol
Glycolic acid butylester
Butyl diglycol acetate
Dipropylene glycol monomethyl ether
2-Methoxyethanol
2-Ethoxyethanol
2-Propoxyethanol
2-Methylethoxyethanol
2-Hexoxyethanol
1,2-Dimethoxyethane
1,2-Diethoxyethane
2-Methoxyethyl acetate
2-Ethoxyethyl acetate
2-(2-Hexoxyethoxy)ethanol
1-Methoxy-2-(2-methoxy-ethoxy)ethane
Propylene glycol diacetate
Dipropylene glycol

Dipropylene glycol monomethylether acetate
Dipropylene glycol n-butylether
Dipropylene glycol n-propyl ether
Di(propylene glycol) tert-butylether
1,4-Butanediol
Tri(propylene glycol) methyl ether
Triethylene glycol dimethyl ether
Propylene glycol dimethyl ether
TXIB (Texanol isobutyrate)
Ethyl diglycol
Dipropylene glycol dimethylether
Propylene carbonate
Hexyleneglycol
3-Methoxy-1-butanol
Propylene glycol n-propyl ether
Propylene glycol n-butyl ether
Diethylene glycol phenyl ether
Neopentyl glycol
Diethylene glycol methyl ether
1-Ethoxy-2-propanol
tert-Butoxy-2-propanol
2-Butoxy ethyl acetate

Aldehydes

Butanal^{1,3}
3-Methyl-1-butanal
Pentanal³
Hexanal
Heptanal
2-Ethylhexanal
Octanal
Nonanal
Decanal
2-Butenal³
2-Pentenal³
2-Hexenal
2-Heptenal
2-Octenal
2-Nonenal
2-Decenal
2-Undecenal
Furfural
Ethanediol (Glyoxal)^{1,3}
Glutaraldehyde
Benzaldehyde
Acetaldehyde^{1,3}
Formaldehyde^{1,3}
Propanal^{1,3}
Propenal^{1,3}
Isobutenal³

Ketones

Ethylmethylketone³
3-Methyl-2-butanone
Methylisobutylketone
Cyclopentanone
Cyclohexanone
Acetone^{1,3}
2-Methylcyclopentanone
2-Methylcyclohexanone
Acetophenone

1-Hydroxyacetone
2-Heptanon

Acids

Acetic acid
Propionic acid
Isobutyric acid
Butyric acid
Pivalic acid
Valeric acid
Caproic acid
Heptanoic acid
Octanoic acid
2-Ethylhexanoic acid

Esters and Lactones

Methylacetate¹
Ethyl acetate¹
Vinyl acetate¹
Isopropyl acetate
Propyl acetate
2-Methoxy-1-methylethyl acetate
n-Butyl formate
Methylmethacrylate
Isobutylacetate
1-Butyl acetate
2-Ethylhexyl acetate
Methyl acrylate
Ethyl acrylate
n-Butyl acrylate
2-Ethylhexyl acrylate
Adipic acid dimethylester
Fumaric acid dibutylester
Succinic acid dimethylester

Glutaric acid dimethylester
Hexandioldiacrylate
Maleic acid dibutylester
Butyrolactone
Glutaric acid diisobutylester
Succinic acid diisobutylester
Dimethylphthalate
Diethylphthalate²
Dipropylphthalate²
Dibutylphthalate²
Diisobutylphthalate²
Dipropyleneglycoldiacrylate

Chlorinated hydrocarbons

Tetrachlorethene
1,1,1-Trichlorethane
Trichlorethene
1,4-Dichlorbenzene
Chlorobenzene

Others

1,4-Dioxane
Caprolactam
N-Methyl-2-pyrrolidone
Octamethylcyclotetrasiloxane
Hexamethylcyclotrisiloxane
Methenamine
2-Butanoxime
Triethyl phosphate
Tributyl phosphate
5-Chlor-2-methyl-4-isothiazolin-3-one (CIT)
2-Methyl-4-isothiazolin-3-one (MIT)
Triethylamine

Decamethylcyclopentasiloxane
Dodecamethylcyclohexasiloxane
Tetrahydrofuran (THF)
1-Decene
Benzothiazole
1-Octene
2-Pentylfuran
2-Methylfuran
Isophorone
Tetramethyl succinonitrile
Dimethylformamide (DMF)
Tributyl phosphate
N-Ethyl-2-pyrrolidone
Aniline
4-Vinylcyclohexene
Dichlormethane
Carbon tetrachloride
Chloroform
Chloroprene (monomer)
Acetamide
Formamide
1,3-Dichlor-2-propanol
2-n-Octyl-4-isothiazolin-3-one (OIT)
Cyclohexylisocyanate

1 VVOC

2 SVOC

3 Analysis according to DIN ISO 16000-3

IV Commentary on emission analysis

Test method

Measurement of the volatile organic compounds takes place in the test chamber in conditions similar to those applying in practice. Standardized test conditions are defined for the test chamber regarding loading, air exchange, relative humidity, temperature and incoming air, based on the type of test specimen and the required guideline. These conditions and the underlying standards are to be found in the section on test methods in the laboratory report.

Air samples are taken from the test chamber at defined points in time during the continuously running test. To this end, approximately 5 L of air are collected from the test chamber with an air flow rate of 100 mL/min for Tenax and approx. 100 L with an air flow rate of 0.8 L/min for DNPH (dinitrophenylhydrazine).

After thermal desorption, the substances adsorbed on Tenax are analysed using gas chromatographic separation and mass spectrometric determination. The gas chromatographic separation is performed with a slightly polar capillary column of 60 m in length.

The substances derivatized with DNPH for the determination of formaldehyde and other short-chain carbonyl compounds (C1 - C6) are analysed using high-performance liquid chromatography.

Over 200 compounds, including volatile organic compounds (C6 - C16), semi-volatile organic compounds (C16 - C22) and – insofar as possible with this method – also very volatile organic compounds (less than C6) are determined and quantified individually.

All other substances – insofar as is possible – are identified through comparison with a library of spectra. The quantification of these substances and non-identified substances is performed through a comparison of their signal area with the signal of the internal standard d8 toluene. As far as possible, identification and quantification limit of any substance shall be 1 µg per m³ for substances adsorbed on Tenax and 2 µg/m³ for DNPH-derivatized substances (limit of quantification).

Quality assurance

The eco-INSTITUT Germany GmbH is granted flexible scope of accreditation pursuant to DIN EN ISO/IEC 17025. The accreditation covers the analytical determination of all volatile organic compounds, including the test chamber method.

In each analysis the analytical system is checked using an external standard based on the specifications in standard DIN EN 16516. The stability of the analytical systems is documented based on the test standard using control charts.

Laboratory performance is assessed at least once a year in inter-laboratory comparisons by comparing the results with those obtained by other laboratories for identical samples.

A blank is run prior to introducing the test specimen into the test chamber to check for the possible presence of volatile organic compounds.

V Explanation of Specific Emission Rate SER

Emission measurements are accomplished in test chambers under defined physical conditions (temperature, relative humidity, room loading, air change rate etc.).

Test chamber measurement results are directly comparable only if the investigations were accomplished under the same basic conditions.

If the differences of the physical conditions refer only to the change of air rate and/or the loading, the "SER" or "specific emission rate" can be used for comparability of the measurement results. The SER indicates how many volatile organic compounds (VOC) are released by the sample for each material unit and hour (h).

The SER can be calculated using the formula below for each proven individual component of the VOC from the data in the test report.

As material units the following are applicable:

l = unit of length (m)	relation between emission and length
a = unit area (m ²)	relation between emission and surface
v = unit volume (m ³)	relation between emission and volume
u = piece unit (unit = piece)	relation between emission and complete unit

From this the different dimensions for SER result:

length-specific	SER _l in µg/(m·h)
surface-specific	SER _a in µg/(m ² ·h)
volume-specific	SER _v in µg/(m ³ ·h)
unit specific	SER _u in µg/(u·h)

SER thus represents a product specific rate, which describes the mass of the volatile organic compound, which is emitted by the product per time unit at a certain time after beginning of the examination.

$$\text{SER} = q \cdot c$$

- q specific air flow rate (quotient from change of air rate and loading)
c concentration of the measured substance(s)

The result can be indicated in milligrams (mg) in place of micro grams (µg), whereby 1 mg = 1000 µg.