

Reichert Holztechnik GmbH & Co. KG
Spielberger Straße 8
72285 Pfalzgrafenweiler

Test Report No. 51014-001 II

Test objective:	Emission analysis according to M1 criteria
Sample description by client:	Reliefholz by nature; Fichte/Tanne spalt- rau natur
Sampled by:	Client
Date of arrival of sample:	19.02.2016
Date of report:	13.04.2016
Number of pages of report:	17
Testing laboratory:	eco-INSTITUT Germany GmbH, Köln
Test objective fulfilled:	✓ Classification M1

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Sample view

Internal Sample-no.	Description by customer	Condition upon delivery	Type of sample
A001	Reliefholz by nature; Fichte/Tanne spaltrau natur	without objection	MDF + solid timber wall cladding



A001: Reliefholz by nature; Fichte/Tanne spaltrau natur

Expert evaluation (M1)

The product **Reliefholz by nature; Fichte/Tanne spaltrau natur** has been tested on behalf of **Reichert Holztechnik GmbH & Co. KG**.

This evaluation bases on the test criteria of the Building Information Foundation RTS.
 The results of the emission analysis are stated as Specific Emission Rate (SER).

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

Test parameter	Result	Requirement Emission class M1	Requirement hold [yes/no]
Emission analysis			
Measurement time: 28 days after test chamber loading			
TVOC (Sum volatile organic compounds) 1)	0,049 mg/m ² h	< 0,2 mg/m ² h	yes
Formaldehyde	0,0065 mg/m ² h	< 0,05 mg/m ² h	yes
Ammonia	< 0,0075 mg/m ² h	< 0,03 mg/m ² h	yes
Sum carcinogenic substances (EU cat. 1A and 1B)	< 0,0005 mg/m ² h	< 0,005 mg/m ² h	yes
Odour test			
Odour / Acceptance	0,5	> 0	yes

1) for TVOC only substances $\geq 5 \mu\text{g}/\text{m}^3$ are considered

Summary evaluation

The product **Reliefholz by nature; Fichte/Tanne spaltrau natur** meets the requirements of the **Emission Class M1** (equivalent for low emitting product acc. to EN 15251:2007).

Cologne, 13.04.2016



Daniel Tigges, Dipl.-Holzwirt
 (Projektleiter)

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.

Laboratory report

1 Emission analysis

Test method

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

Preparation of test sample

Date: 01.03.2016
Pre-treatment: not applicable
Masking of backside: yes
Masking of edges: yes, 100 %
Relationship of unmasked edges to surface: not applicable
Charging: related to area
Dimensions: 36,3 cm x 34,4 cm

Test chamber conditions according to DIN ISO 16000-9

Chamber volume: 0,125 m³
Temperature: 23 °C
Relative humidity: 50 %
Air pressure: normal
Air: cleaned
Air change rate: 0,5 h⁻¹
Air velocity: 0,3 m/s
Loading: 1,0 m²/m³
Specific air flow rate: 0,5 m³/m² · h
Air sampling: 28 days after test chamber loading

Analytics

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

1.1 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: Reliefholz by nature; Fichte/Tanne spaltrau natur

No.	Substance	CAS No.	RT [min]	Concentration+ (test chamber air) Substances $\geq 1 \mu\text{g}/\text{m}^3$ 28 days [$\mu\text{g}/\text{m}^3$]	Toluene- equivalent Substances $\geq 5 \mu\text{g}/\text{m}^3$ 28 days [$\mu\text{g}/\text{m}^3$]	CMR Classifi- cation	LCI AgBB 2015 [$\mu\text{g}/\text{m}^3$]	R-value
3	Terpenes							
3-2	α -Pinene	80-56-8	11,77	1			2500	0,00
3-3	β -Pinene	127-91-3	12,84	1			1400	0,00
4	Aliphatic alcohols (n-, iso-, cyclo) and dialkole							
4-6	1-Butanol	71-36-3	11,77	1			3000	0,00
4-7	Pentanol (all isomers)	71-41-0	12,84	1	6		730	0,00
7	Aldehyde							
7-2	Pentanal	110-62-3	6,54	4	6		800	0,01
7-3	Hexanal	66-25-1	8,52	25	28		900	0,03
7-6	Octanal	124-13-0	12,99	1			900	0,00
7-7	Nonanal	124-19-6	15,17	1			900	0,00
7-20	Acetaldehyde	75-07-0		5		K2	1200	0,00
7-22	Formaldehyde	50-00-0		13		K1BM2	100	0,13
8	Ketones							
8-1	Ethylmethylketone	78-93-3		2			5000	0,00
8-10	Acetone	67-64-1		20			1200	0,02

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No.	Substance	CAS No.	RT [min]	Concentration+ (test chamber air) Substances ≥ 1 µg/m³ 28 days [µg/m³]	Toluene- equivalent Substances ≥ 5 µg/m³ 28 days [µg/m³]	CMR Classifi- cation	LCI AgBB 2015 [µg/m³]	R-value
9	Acids							
9-1	Acetic acid	64-19-7	4,84	150	44		1250	0,12
9-2	Propionic acid	79-09-4	6,02	7			310	0,02
9-7	n-Caproic acid (n-Hexa- noic acid)	142-62-1	11,99	8	5		490	0,02
10	Esters							
10-11	1 Butyl acetate	123-86-4	8,68	8	9		4800	0,00
	Carboxylic acid esters*		17,03	1				
	Carboxylic acid esters *		18,05	1				
	several Carboxylic acid esters*		27,0- 29,0	14	14			

+ 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: K1 and K2, M1 and M2, R1 and R2, IARC: Group 1 and 2A, DFG MAK-list: Kategorie III1 and III2

* unidentified substance, calculated as toluene equivalent

Carcinogenic, mutagenic and reproductive toxic components	Concentration after 28 days [µg/m³]	SER _a [µg/m³h]
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: K1, K2, M1, M2, R1, R2; IARC: Group 1 and 2A; DFG (MAK list): Categories III1, III2 (Sum)	< 1	< 0,5
C 1: VOC (incl. VVOC and SVOC) with the following categorisations: Regulation (EG) Nr. 1272/2008: Category Carc. 1A u. 1B, TRGS 905: K1, K2; IARC: Group 1 u. 2A; DFG (MAK-list): Category III1, III2 (Sum)	< 1	< 0,5

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TVOC, Total volatile organic compounds	Concentration after 28 days [µg/m³]	SER_a [µg/m²h]
Sum of VOC according to prEN 16516	98	49
Sum of VOC according to AgBB 2015 / DIBt	200	99
Sum of VOC according to eco-INSTITUT-Label	210	110
Sum of VOC according to ISO 16000-6	160	80

TSVOC, Total semi volatile organic compounds	Concentration after 28 days [µg/m³]	SER_a [µg/m²h]
Sum of SVOC according to prEN 16516	14	7
Sum of SVOC without LCI according to AgBB 2015 / DIBt	14	7
Sum of SVOC without LCI according to eco-INSTITUT-Label	14	7
Sum of SVOC with LCI according to AgBB 2015 / DIBt	< 5	< 2,5

TVVOC, Total very volatile organic compounds	Concentration after 28 days [µg/m³]	SER_a [µg/m²h]
Sum of VVOC according to AgBB 2015 / DIBt and Belgian regulation	38	19
Sum of VVOC according to eco-INSTITUT-Label	38	19

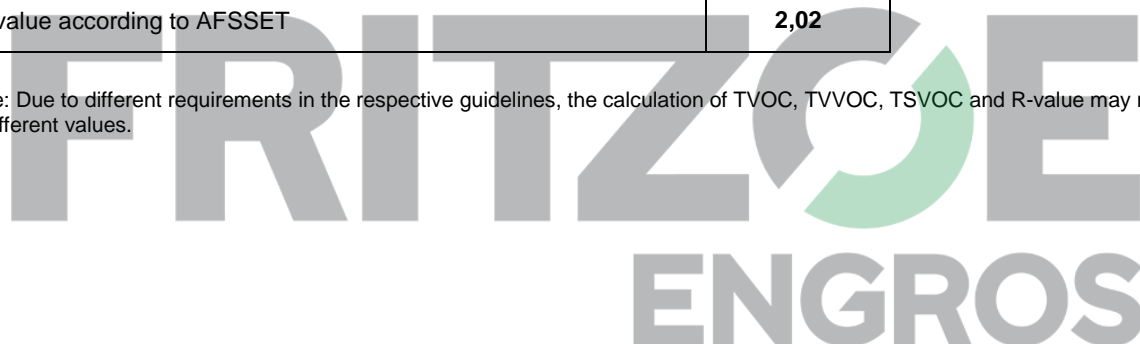
Other groups	Concentration after 28 days [µg/m³]	SER_a [µg/m²h]
VOC without LCI according to AgBB/DIBt and Belgian regulation (sum)	< 5	< 2,5
VOC without LCI according to eco-INSTITUT-Label (sum)	2	1
CMR 2: VOC (incl. VVOC and SVOC) with the following categorisations: Regulation (EC) No. 1272/2008: Category Carc. 2, Muta. 2, Repr. 2; TRGS 905: K3; IARC: Group 2B; DFG (MAK list): Category III3 (Sum)	5	2,5
Sensitising compounds with the following categorisations: DFG (MAK list): Category IV, German Federal Institute for Risk Assessment lists: Cat A, TRGS 907 (Sum)	2	1

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Other groups	Concentration after 28 days [µg/m³]	SER _a [µg/m²h]
Bicyclic Terpenes	2	1
C9 - C14: Alkanes / Isoalkanes as dekane-equivalent (Sum)	< 1	< 0,5
C4-C11 Aldehydes, acyclic, aliphatic (Sum)	31	16
C9-C15 Alkylated benzenes (Sum)	< 1	< 0,5
Kresoles (Sum)	< 1	< 0,5

Risk value for assessment of LCI	R-value
R-value according to eco-INSTITUT-Label	0,35
R-value according to AgBB 2015 / DIBt	0,34
R-value according to Belgian regulation	0,19
R-value according to AFSSET	2,02

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



1.2 Ammonia

Test parameter:

Ammonia

Test method:

Analytics:

UV/VIS Spectrometric analysis, Method of DIBt (German Institute for Structural Engineering)

Limit of determination:

15 µg/m³

Test result:

Sample:	Measurement after [days]	Concentration (Test chamber air) [µg/m ³]
Reliefholz by nature; Fichte/Tanne spaltrau natur	28	<15



2 Odour

Test parameter:

Odour, test collective, odour test 28 days after test chamber loading

Test method:

Preparation of test sample:	see 1.1. Volatile organic compounds
Test chamber conditions:	see 1.1. Volatile organic compounds
Air sampling:	28 days after test chamber loading
Analytics:	following DIN EN ISO 16000-28
Probands:	Quantity: 15 therefrom female: 5
Evaluation:	Acceptance Continuous scale from +1 (clearly acceptable) to -1 (clearly unacceptable)

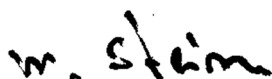
Test result:

Sample: A001: Reliefholz by nature; Fichte/Tanne spaltrau natur

	Acceptance
Arithmetical mean	0,5

	Acceptance
Arithmetical mean (background)	0,9
Standard deviation	0,3
half width of the 90% confidence interval	0,2

Cologne, 13.04.2016



Michael Stein, Dipl.-Chem.
(Deputy Technical Manager)

Appendix

I Sampling Sheet

Produktprüfung Product testing
 Zertifizierung Certification
 Beratung Consulting

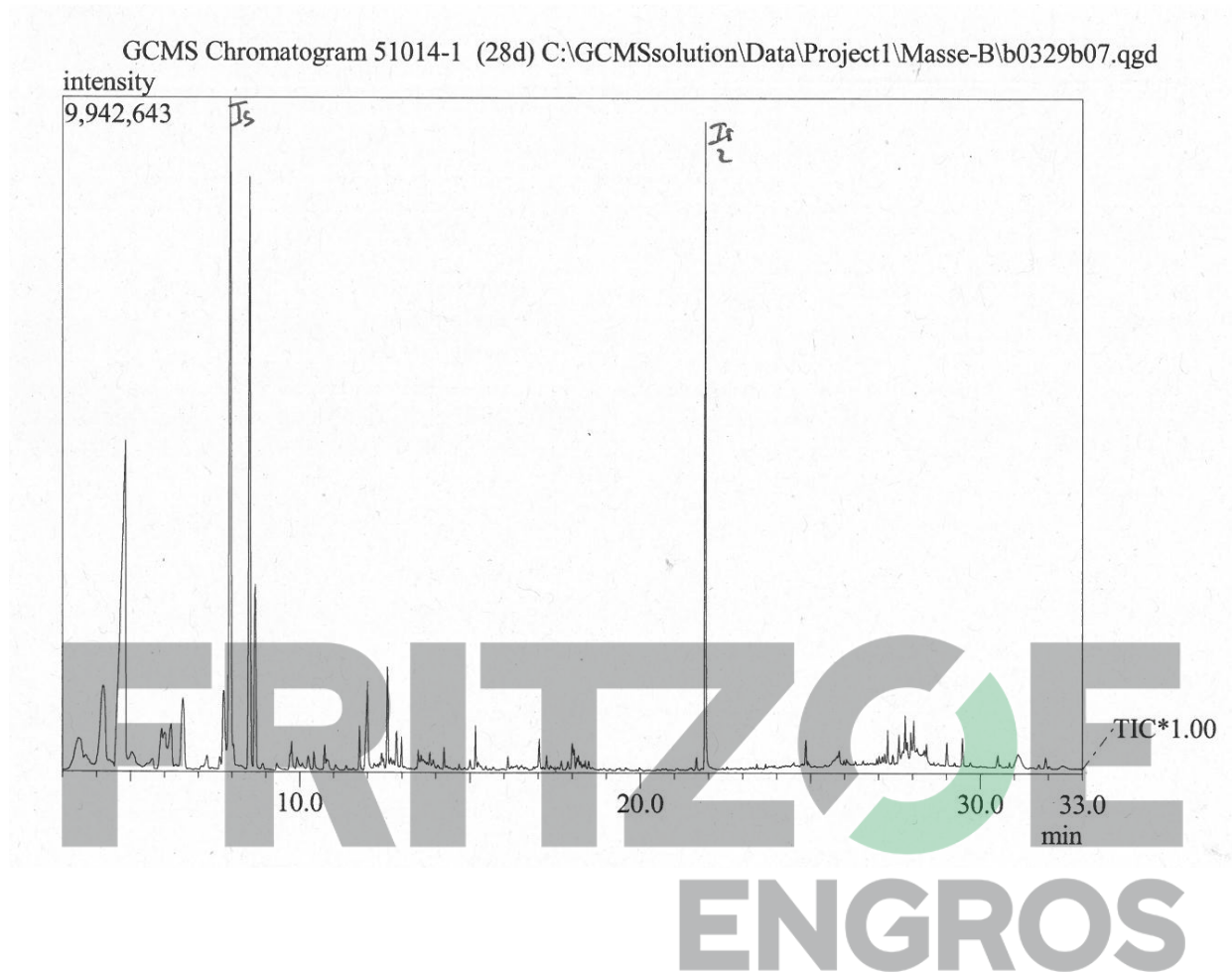


Probenahmebegleitblatt*

Prüflabor eco-INSTITUT Germany GmbH Schanzenstr. 6-20, D-51063 Köln Tel. +49 (0)221 - 931245-0 Fax +49 (0)221 - 931245-33	Probenehmer (Name, Firma, Telefon) Jürgen Geisen, etc 07445 - 8503 - 17
Name des Herstellers / Händlers am Probenahmeort (Adresse / Stempel) Reichert Holztechnik GmbH & Co. KG Spielberger Str. 8 72285 Pfalzgrafenweiler	Produkthersteller (falls abweichend vom Firmennamen am Probenahmeort) etc
Produktname Reliefholz by nature	Probeart (z.B. Holzwerkstoff, Bodenbelag) MDF + Massivholz Wandverkleidung
Modell / Programm / Serie Fichte / Tanne Spalttrauf natur	Chargen-Nr. 16.02.2016
Artikel-Nr.	Produktionsdatum der Charge 16.02.2016
Probe wird gezogen ... <input checked="" type="checkbox"/> aus der laufenden Produktion <input type="checkbox"/> aus Lagerbeständen	Datum der Probenahme 18.02.2016
Wo wurde das Produkt vor Probenahme gelagert? <input checked="" type="checkbox"/> Fertigung <input type="checkbox"/> Lager <input type="checkbox"/> Sonstiges Lagerort: Produktion W3	Uhrzeit 8:15
	Wie wurde das Produkt vor Probenahme gelagert? <input type="checkbox"/> offen <input checked="" type="checkbox"/> verpackt Verpackungsmaterial: Karton + BE-Folie
Besonderheiten (mögliche negative Einflüsse durch Emissionen am Probenahmeort, Benzin-Abgase, Lösemittlemissionen aus der Fertigung, Unklarheiten, Fragen, etc.)	
Bestätigung Hiermit bestätigt der Unterzeichner die Richtigkeit der oben gemachten Angaben. Die Probe wurde eigenhändig gemäß Probenahmeanleitung ausgewählt, gezogen und verpackt.	
Datum: 18.02.16	Unterschrift: (Stempel) ppa. J. Geisen
Reichert Holztechnik GmbH & Co. KG Postfach 12 28 72285 Pfalzgrafenweiler Spielberger Str. 8 72285 Pfalzgrafenweiler Telefon 0 74 45 / 85 03 - 0 Telefax 0 74 45 / 85 03 - 13	

* Bitte pro Probe ein Probenahmebegleitblatt ausfüllen! Die Probenahmeanleitung ist unbedingt einzuhalten!

II Chromatogram



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III 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 prEN 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: K1 and K2, M1 and M2, R1 and R2 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 prEN 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)

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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 2015
R value according to AgBB 2015/DIBt	R value for all identified and calibrated VOC $\geq 5 \mu\text{g}/\text{m}^3$ with LCI, established by the AgBB in 2015
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


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IV List of analysed Volatile Organic Compounds (VOC)

Aromatic hydrocarbons	1-Heptanol	Nonanal	Dibutylphthalate ²
Toluene	1-Nonanol	Decanal	Diisobutylphthalate ²
Ethylbenzene	1-Decanol	2-Butenal ³	Texanol
<i>p</i> -Xylene	1,4-Cyclohexandimethanol	2-Pentenal ³	Dipropylene glycol diacrylate
<i>m</i> -Xylene		2-Hexenal	
<i>o</i> -Xylene	Aromatic alcohols (phenoles)	2-Heptenal	Chlorinated hydrocarbons
Isopropylbenzene	Phenol	2-Undecenal	Tetrachlorethene
<i>n</i> -Propylbenzene	BHT (2,6-Di- <i>tert</i> -butyl-4-methylphenol)	Furfural	1,1,1-Trichlorethane
1,3,5-Trimethylbenzene		Glutaraldehyde	Trichlorethene
1,2,4-Trimethylbenzene	Benzyl alcohol	Benzaldehyde	1,4-Dichlorbenzene
1,2,3-Trimethylbenzene	Cresols	Acetaldehyde ^{1,3}	
2-Ethyltoluene		Propanal ^{1,3}	Others
1-Isopropyl-4-methylbenzene	Glycols, Glycol ether, Glycol ester	Propenal ^{1,3}	1,4-Dioxane
1,2,4,5-Tetramethylbenzene	Propylene glycol (1,2-Dihydroxypropane)	Isobutenal ³	Caprolactam
<i>n</i> -Butylbenzene	Ethylene glycol (Ethandiol)	2-Octenal	<i>N</i> -Methyl-2-pyrrolidone
1,3-Diisopropylbenzene	Ethylene glycol monobutyl ether	2-Nonenal	Octamethylcyclotetrasiloxane
1,4-Diisopropylbenzene	Diethylene glycol	2-Decenal	Hexamethylcyclotrisiloxane
Phenylacetone	Diethylene glycol-monobutyl ether		Methenamine
1-Phenyldecane ²	2-Phenoxyethanol	Ketones	2-Butanonoxime
1-Phenylundecane ²	Ethylene carbonate	Ethylmethylketone ³	Triethyl phosphate
4-Phenylcyclohexene	1-Methoxy-2-propanol	3-Methyl-2-butanone	5-Chlor-2-methyl-4-isothiazolin-3-one
Styrene	Texanol	Methylisobutylketone	2-Methyl-4-isothiazolin-3-one (MIT)
Phenylacetylene	Glycolic acid butylester	Cyclopentanone	Triethylamine
2-Phenylpropene	Butyl diglycol acetate	Cyclohexanone	Decamethylcyclopentasiloxane
Vinyltoluene	Dipropylene glycol monomethyl ether	Acetone ^{1,3}	Dodecamethylcyclohexasiloxane
Naphthalene	2-Methoxyethanol	2-Methylcyclopentanone	Tetrahydrofuran (THF)
Indene	2-Ethoxyethanol	2-Methylcyclohexanone	1-Decene
Benzene	2-Propoxyethanol	Acetophenone	1-Octene
1-Methylnaphthalene	2-Methylethoxyethanol	1-Hydroxyacetone	2-Pentylfuran
2-Methylnaphthalene	2-Hexoxyethanol		Isophorone
1,4-Dimethylnaphthalene	1,2-Dimethoxyethane	Acids	Tetramethyl succinonitrile
	1,2-Diethoxyethane	Acetic acid	Dimethylformamide (DMF)
Saturated aliphatic substances	2-Methoxyethyl acetate	Propionic acid	Tributyl phosphate
2-Methylpentane ¹	2-Ethoxyethyl acetate	Isobutyric acid	<i>N</i> -Ethyl-2-pyrrolidone
3-Methylpentane ¹	2-(2-Hexoxyethoxy)ethanol	Butyric acid	Aniline
<i>n</i> -Hexane	1-Methoxy-2-(2-methoxyethoxy)ethane	Pivalic acid	4-Vinylcyclohexene
Cyclohexane	Propylene glycol diacetate	Valeric acid	
Methylcyclohexane	Dipropylene glycol	Caproic acid	1 VVOC
<i>n</i> -Heptane	Dipropylene glycol monomethylether acetate	Heptanoic acid	2 SVOC
<i>n</i> -Octane	Dipropylene glycol <i>n</i> -propyl ether	Octanoic acid	3 Analysis according to DIN ISO 16000-3
<i>n</i> -Nonane	Di(propylene glycol) <i>tert</i> -butylether	2-Ethylhexanoic acid	
<i>n</i> -Decane	1,4-Butanediol	Esters and Lactones	
<i>n</i> -Undecane	Tri(propylene glycol) methyl ether	Methylacetate ¹	
<i>n</i> -Dodecane	Triethylene glycol dimethyl ether	Ethyl acetate ¹	
<i>n</i> -Tridecane	Propylene glycol dimethyl ether	Vinyl acetate ¹	
<i>n</i> -Tetradecane	TXIB (Texanol isobutyrate)	Isopropyl acetate	
<i>n</i> -Pentadecane	Ethyl diglycol	Propyl acetate	
1-Butanol	Dipropylene glycol dimethylene ether	2-Methoxy-1-methylethyl acetate	
1-Pentanol	Propylene carbonate	<i>n</i> -Butyl formate	
1-Hexanol	Hexyleneglycol	Methylmethacrylate	
<i>n</i> -Hexadecane	3-Methoxy-1-butanol	Isobutylacetate	
Methylcyclopentane	Propylene glycol <i>n</i> -propyl ether	1-Butyl acetate	
1,4-Dimethylcyclohexane	Propylene glycol <i>n</i> -butyl ether	2-Ethylhexyl acetate	
	Diethylene glycol phenyl ether	Methyl acrylate	
Terpenes	Neopentyl glycol	Ethyl acrylate	
δ-3-Carene	Diethylene glycol methyl ether	<i>n</i> -Butyl acrylate	
α-Pinene	1-Ethoxy-2-propanol	2-Ethylhexyl acrylate	
β-Pinene	<i>tert</i> -Butoxy-2-propanol	Adipic acid dimethylester	
Limonene		Fumaric acid dibutylester	
		Succinic acid dimethylester	
Aliphatic alcohols and ether		Glutaric acid dimethylester	
1-Propanol ¹	Aldehydes	Hexandioldiacrylate	
2-Propanol ¹	Butanal ^{1,3}	Maleic acid dibutylester	
<i>tert</i> -Butanol	Pentanal ³	Butyrolactone	
Cyclohexanol	Hexanal	Glutaric acid diisobutylester	
2-Ethyl-1-hexanol	Heptanal	Succinic acid diisobutylester	
2-Methyl-1-propanol	2-Ethylhexanal	Dimethylphthalate	
1-Octanol	Octanal	Diethylphthalate ²	
4-Hydroxy-4-methyl-2-pentanone		Dipropylphthalate ²	

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V 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 toluene signal.

The concentrations of substances that have been determined are corrected based on the recovery rate for an internal standard (d8 toluene). Identification and quantification of the substances is limited to 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 prEN 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.

VI 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.