eco-INSTITUT Germany GmbH
Laborprüfung
Laboratory testing

Novaya Belgium NV
Sint Amandstraat 8b
8700 Tielt, Belgium
Belgium

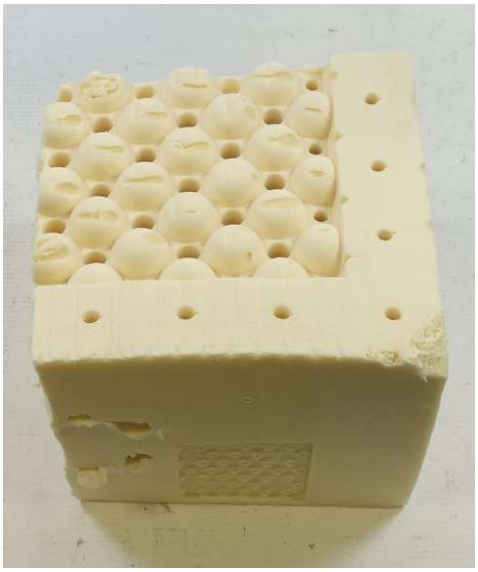
Test Report No. 59500-A002-L

Test objective:	**Analysis according to eco-INSTITUT-Label-criteria**
Article designation according to order:	**Natural Latex Foam - made from 100 % natural latex (Article no.: 87871)**
Date of report:	03/12/2024
Number of pages of report:	25
Testing / responsible laboratory:	eco-INSTITUT Germany GmbH, Köln
Note:	The test results in the report refer exclusively to the submitted test sample. The report may only be used in product and company advertising if a valid certificate is available that refers to this report. More information at www.eco-institut.de/en/advertising

Content

‡ subcontracted, # outside accreditation

Sample View

Internal sample number (filled in by laboratory)	**59500-A002**
Photo of the test specimen: A002	
Article designation according to order:	Natural Latex Foam - made from 100 % natural latex (Article no.: 87871)
Sample/batch number according to order:	20739
Type of sample:	Natural latex foam
Date of production:	09/10/2024
Sampling by:	no information
Date of sampling:	10/10/2024
Location of sampling:	Novaya Belgium
Receipt of sample / Condition upon delivery:	15/10/2024 / without objection

Laboratory report

1 Emission analysis

Test method

DIN EN 16516:2020-10	Testing and evaluation of the release of dangerous substances; determination of emissions into indoor air

A002, Preparation of test specimen

Date:	04/11/2024
Test specimen preparation:	Sample cut to size; transfer of the test specimen into the test chamber immediately after preparation
Masking of backside:	no
Masking of edges:	no
Relationship of unmasked edges to surface:	not applicable
Arrangement in test chamber:	on stand
Loading reference unit:	area-specific [m^2]
Dimensions:	16.9 cm x 16.9 cm; thickness: 15.5 cm

A002, Test chamber conditions according to DIN EN ISO 16000-9:2008-04

Chamber volume:	0.250 m^3
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:	0.65 m^2/m^3
Specific air flow rate:	0.769 $m^3/(m^2 \cdot h)$
Starting time of the test (t0):	04/11/2024
Air sampling:	2 days after test chamber loading 7 days after test chamber loading

Analytics

Aldehydes and ketones:	DIN ISO 16000-3:2023-12
Limit of quantification:	2 µg/m^3
Volatile organic compounds:	DIN ISO 16000-6:2022-03
Limit of quantification:	1 µg/m^3 (1,4-Cyclohexanedimethanol, Diethylene glycol, 1,4-Butanediol: 5 µg/m^3)
Note for analysis:	not specified

1.1 Sample A002, Volatile organic compounds after 2 days

Test objective:

Volatile organic compounds (VOC), test chamber, air sampling 2 days after test chamber loading

Test result:

Internal sample number: | 59500-A002

	Substance	CAS No.	RT [min]	Concentration+ calib. substances ≥ 1 µg/m³ uncalib. substances ≥ 1 µg/m³ DNPH ≥ 2 µg/m³ [µg/m³]	Toluene-equivalent substances ≥ 5 µg/m³ [µg/m³]	SER+ [µg/(m²·h)]	CMR Classification++	LCI AgBB 2024 [µg/m³]	R-value
	Aromatic alcohols								
VOC	Benzyl alcohol	100-51-6	14.22	2	< 5	1.5	Group 3	440	0.00
	Aldehydes								
VOC	Benzaldehyde	100-52-7	12.76	2	< 5	1.5		90	0.02
VVOC	Formaldehyde	50-00-0		5	n. d.	3.8	Carc. 1B Muta. 2	100	0.05
	Acids								
VOC	Acetic acid	64-19-7	4.98	28	< 5	22		1200	0.02
	Other identified substances in addition to LCI list								
VOC	Benzothiazole	95-16-9	18.98	2	< 5	1.5			
VOC	2,2,4,6,6-Pentamethylheptane	13475-82-6	13.21	1	< 5	0.77		6000	0.00
VOC	Aniline	62-53-3	13.02	18	5	14	Group 2A		
VVOC	Unident. VVOC, m/z 42 57*		4.11	2	< 5	1.5			
VVOC	Ethylmethylamine*		4.33	1	< 5	0.77			
VVOC	Diethylimine*		4.66	4	< 5	3.1			
VVOC	Diethylamine*		4.94	74	74	57			
VOC	Diethylmethylamine*		5.45	2	< 5	1.5			

	Substance	CAS No.	RT	Concentration+ calib. substances ≥ 1 µg/m³ uncalib. substances ≥ 1 µg/m³ DNPH ≥ 2 µg/m³	Toluene-equivalent substances ≥ 5 µg/m³	SER+	CMR Classifi-cation++	LCI AgBB 2024	R-value
			[min]	[µg/m³]	[µg/m³]	[µg/(m²·h)]		[µg/m³]	
VOC	Unident. VOC, m/z 105 77 51*		12.36	2	< 5	1.5			
VOC	Unident. VOC, m/z 57*		13.85	1	< 5	0.77			

+ identified and calibrated substances, substance specific calculated
++ classification according to Regulation (EG) N° 1272/2008: Categories Carc. 1A, 1B and 2, Muta. 1A, 1B and 2, Repr. 1A, 1B and 2, TRGS 905: K1A, K1B, K2, M1A, M1B, M2, R1A, R1B, R2; IARC: Group 1, 2A, 2B and 3, DFG MAK-list: Categorie III1 to III5
* unidentified substances, calculated as toluene equivalent reported with significant mass fragments as mass-to-charge ratio (m/z)
n. d.: not determined

Carcinogenic, mutagenic, and reproductive toxic compounds*	Concentration after 2 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)	18	14
C 1: VOC (incl. VVOC and SVOC) with the following categorisations: Regulation (EG) Nr. 1272/2008: Category Carc. 1A u. 1B; TRGS 905: K1A, K1B (sum)	< 1	< 0.77

TVOC, Total volatile organic compounds	Concentration after 2 days [µg/m³]	SERa [µg/(m² • h)]
Sum of VOC according to DIN EN 16516	5	3.8
Sum of VOC according to AgBB 2024	33	25
Sum of VOC according to eco-INSTITUT-Label	58	45
Sum of VOC according to DIN ISO 16000-6	65	50

TSVOC, Total semi volatile organic compounds	Concentration after 2 days [µg/m³]	SERa [µg/(m² • h)]
Sum of SVOC according to DIN EN 16516	< 5	< 3.8
Sum of SVOC without LCI according to AgBB 2024	< 5	< 3.8
Sum of SVOC without LCI according to eco-INSTITUT-Label	< 1	< 0.77
Sum of SVOC with LCI according to AgBB 2024	< 5	< 3.8

TVVOC, Total very volatile organic compounds	Concentration after 2 days [µg/m³]	SERa [µg/(m² • h)]
Sum of VVOC according to AgBB 2024	79	61
Sum of VVOC according to eco-INSTITUT-Label	86	66

*Excluding formaldehyde and acetaldehyde (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 and protocol of the 11th meeting of 'Ausschusses für Innenraumrichtwerte' (AIR), 11/2020). In the case of a toxicological emission assessment, a single-substance analysis of the concentrations 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).

Other sums of VOC	Concentration after 2 days [µg/m³]	SERa [µg/(m² • h)]
VOC without LCI according to AgBB 2024 (sum)	5	3.8
VOC without LCI according to eco-INSTITUT-Label (sum)	25	19
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: K2, M2, R2; IARC: Group 2B; DFG (MAK list): Category III3 (sum)	5	3.8
Sensitising compounds with the following categorisations: DFG (MAK list): Category IV; Regulation (EC) No. 1272/2008: skin sensitising, respiratory sensitising; TRGS 907 (sum)	23	18
Bicyclic Terpenes (sum)	< 1	< 0.77
C9 - C14 Alkanes / Isoalkanes as dekane-equivalent (sum)	1	< 0.77
C4 - C11 Aldehydes, acyclic, aliphatic (sum)	< 2	< 1.5
C9 - C15 Alkylated benzenes (sum)	< 1	< 0.77
Kresoles (sum)	< 1	< 0.77

Risk value for assessment of LCI	R-value
R-value according to eco-INSTITUT-Label	0.10
R-value according to AgBB 2024	0.07
R-value according to Belgian regulation	0.07
R-value according to EU-LCI	0.07

Note:
Due to different requirements in the respective guidelines, the calculation of TVOC, TVVOC, TSVOC and R-value may result in different values.
Short-chain carbonyl compounds (C1-C5) are quantified via HPLC acc. to DIN ISO 16000-3:2013-01. Therefore, no toluene equivalents are given for VVOC. These substances are taken into concern by means of their substance specific calibration via the sum of VVOC acc. to DIN EN 16516:2020-10. For VOC however, the substance specific calibration takes place via HPLC whereas the TVOC is calculated using the toluene equivalent determined via Tenax acc. to DIN EN 16516:2020-10.

1.2 Sample A002, Volatile organic compounds after 7 days

Test objective:

Volatile organic compounds (VOC), test chamber, air sampling 7 days after test chamber loading

Test result:

Internal sample number: | 59500-A002

	Substance	CAS No.	RT [min]	Concentration+ calib. substances ≥ 1 µg/m³ uncalib. substances ≥ 1 µg/m³ DNPH ≥ 2 µg/m³ [µg/m³]	Toluene-equivalent substances ≥ 5 µg/m³ [µg/m³]	SER+ [µg/(m²·h)]	CMR Classifi-cation++	LCI AgBB 2024 [µg/m³]	R-value
	Aldehydes								
VVOC	Formaldehyde	50-00-0		3	n. d.	2.3	Carc. 1B Muta. 2	100	0.03
	Acids								
VOC	Acetic acid	64-19-7	4.39	11	< 5	8.5		1200	0.01
	Other identified substances in addition to LCI list								
VOC	Benzothiazole	95-16-9	19.18	2	< 5	1.5			
VOC	Aniline	62-53-3	13.11	9	6	6.9	Group 2A		
VVOC	Diethylamine*		4.49	16	16	12			

+ identified and calibrated substances, substance specific calculated
++ classification according to Regulation (EG) N° 1272/2008: Categories Carc. 1A, 1B and 2, Muta. 1A, 1B and 2, Repr. 1A, 1B and 2, TRGS 905: K1A, K1B, K2, M1A, M1B, M2, R1A, R1B, R2; IARC: Group 1, 2A, 2B and 3, DFG MAK-list: Categorie III1 to III5
* unidentified substances, calculated as toluene equivalent reported with significant mass fragments as mass-to-charge ratio (m/z)
n. d.: not determined

Carcinogenic, mutagenic, and reproductive toxic compounds*	Concentration after 7 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)	9	6.9
C 1: VOC (incl. VVOC and SVOC) with the following categorisations: Regulation (EG) Nr. 1272/2008: Category Carc. 1A u. 1B; TRGS 905: K1A, K1B (sum)	< 1	< 0.77

TVOC, Total volatile organic compounds	Concentration after 7 days [µg/m³]	SERa [µg/(m² • h)]
Sum of VOC according to DIN EN 16516	6	4.6
Sum of VOC according to AgBB 2024	17	13
Sum of VOC according to eco-INSTITUT-Label	22	17
Sum of VOC according to DIN ISO 16000-6	20	15

TSVOC, Total semi volatile organic compounds	Concentration after 7 days [µg/m³]	SERa [µg/(m² • h)]
Sum of SVOC according to DIN EN 16516	< 5	< 3.8
Sum of SVOC without LCI according to AgBB 2024	< 5	< 3.8
Sum of SVOC without LCI according to eco-INSTITUT-Label	< 1	< 0.77
Sum of SVOC with LCI according to AgBB 2024	< 5	< 3.8

TVVOC, Total very volatile organic compounds	Concentration after 7 days [µg/m³]	SERa [µg/(m² • h)]
Sum of VVOC according to AgBB 2024	16	12
Sum of VVOC according to eco-INSTITUT-Label	19	15

*Excluding formaldehyde and acetaldehyde (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 and protocol of the 11th meeting of 'Ausschusses für Innenraumrichtwerte' (AIR), 11/2020). In the case of a toxicological emission assessment, a single-substance analysis of the concentrations 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).

Other sums of VOC	Concentration after 7 days [µg/m³]	SERa [µg/(m² • h)]
VOC without LCI according to AgBB 2024 (sum)	6	4.6
VOC without LCI according to eco-INSTITUT-Label (sum)	11	8.5
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: K2, M2, R2; IARC: Group 2B; DFG (MAK list): Category III3 (sum)	3	2.3
Sensitising compounds with the following categorisations: DFG (MAK list): Category IV; Regulation (EC) No. 1272/2008: skin sensitising, respiratory sensitising; TRGS 907 (sum)	12	9.2
Bicyclic Terpenes (sum)	< 1	< 0.77
C9 - C14 Alkanes / Isoalkanes as dekane-equivalent (sum)	< 1	< 0.77
C4 - C11 Aldehydes, acyclic, aliphatic (sum)	< 2	< 1.5
C9 - C15 Alkylated benzenes (sum)	< 1	< 0.77
Cresols (sum)	< 1	< 0.77

Risk value for assessment of LCI	R-value
R-value according to eco-INSTITUT-Label	0.04
R-value according to AgBB 2024	0.01
R-value according to Belgian regulation	0.01
R-value according to EU-LCI	0.01

Note:
Due to different requirements in the respective guidelines, the calculation of TVOC, TVVOC, TSVOC and R-value may result in different values.
Short-chain carbonyl compounds (C1-C5) are quantified via HPLC acc. to DIN ISO 16000-3:2013-01. Therefore, no toluene equivalents are given for VVOC. These substances are taken into concern by means of their substance specific calibration via the sum of VVOC acc. to DIN EN 16516:2020-10. For VOC however, the substance specific calibration takes place via HPLC whereas the TVOC is calculated using the toluene equivalent determined via Tenax acc. to DIN EN 16516:2020-10.

1.3 Carbon disulfide (CS_2, test chamber)

Test parameter:
Carbon disulfide (CS_2)

Test method:

Analytics:	DIN ISO 16000-6:2022-03

Test result:

Internal Sample number	Measurement time (after test chamber loading)	Concentration (test chamber) [µg/m³]	Limit of quantification [µg/m³]
59500-A002	2 days	8	1

1.4 Ammonia (test chamber)

Test parameter:

Ammonia, test chamber

Test method:

Method description / Analytics:	Sampling from test chamber air according to DIN EN 16516:2020-10 using silica gel tubes with sulfuric acid coating. Determination of the ammonia concentration via UV/VIS spectroscopic determination of the indophenol concentration formed by the Berthelot reaction (analogous to ISO 7150-1:1984).
Limit of quantification:	10 µg/m³

Test result:

Internal sample number	Measurement time (after test chamber loading)	Concentration (Test chamber air) [µg/m³]	Specific Emission Rate (SER) [µg/(m²·h)]
59500-A002	7 days	180	140

1.5 Nitrosamines (test chamber) ‡#

Test parameter:

Determination of Nitrosamines

Test method:

Method description / analytics:	IFA 8172 (IV/18) resp. DGUV-Information 213-523 (09/2019)

Test result:

Internal sample number	Parameter	Measurement time (after test chamber loading)	Concentration (test chamber air) [ng/m³]	limit of quantification [ng/m³]
59500-A002	N-Nitrosodimethylamine (NDMA)	2 days	< LOQ	20
	N-Nitrosomethylethylamine (NMEA)		< LOQ	20
	N-Nitrosodiethylamine (NDEA)		110	20
	N-Nitrosodiisopropylamine (NDIPA)		< LOQ	20
	N-Nitrosodiisobutylamine (NDIBA)		< LOQ	20
	N-Nitrosodipropylamine (NDPA)		< LOQ	20
	N-Nitrosodibutylamine (NDBA)		< LOQ	20
	N-Nitrosopyrrolidine (NPYR)		< LOQ	20
	N-Nitrosopiperidine (NPIP)		< LOQ	20
	N-Nitrosomorpholine (NMOR)		< LOQ	20

< LOQ = Value below limit of quantification

Remark: Concentrations below the limit of quantification are between limit of detection and limit of quantification and provide only qualitative evidence.

2 Odour Testing

Test parameter:
Assessment of odour emissions

Test Method:

Analytics:	Determination of odour as part of the eco-INSTITUT-Label-Certification, house method (following VDA recommendation 270:2018)

Test result

Internal sample number:	59500-A002

Test conditions

Test chamber	see 1 Emission analysis
Air sampling [days]	2
Probands	6
Therefrom female	2
Evaluation Acceptance	Continuous scale from +1 (not perceptible) to +6 (unbearable)

	Evaluation
Odour intensity after 2 days (arithmetic mean)	2.9

Individual results:

Test person	Odour after 2 days [Note]
Test person 01	3.0
Test person 02	4.0
Test person 03	3.0
Test person 04	2.0
Test person 05	3.0
Test person 06	2.5

3 Polymer content

Test parameter:
Relation between natural rubber (NR) and synthetic rubber (SBR)

Test method:

Method description / Analytics:	IR/ATR

Test result:

Internal sample number	Polymer content	[weight/%]
59500-A002	NR, with reference to the polymer content [1) 2) 3)]	100
	SBR, with reference to the polymer content	0

[1)] The relative expanded measurement uncertainty (k=2) for the content of NR is 21.6 %.
[2)] If NR content is < 5 %, the result is shown as 100 % SBR. Usually there is no use of NR below 5 % in a mixture of NR and SBR.
[3)] The content of NR is based on the assumption that polyisoprene in latex mattresses is always of natural origin.

4 Ash content

Test parameter:
Ash content, filler content

Test method:

Analytics:	Thermogravimetry at 520 °C Thermogravimetry at 900 °C for filler content ≥ 5 % at 520 °C Reproducibility of the analytical balance: 0.2 mg

Test result:

Internal sample number:	59500-A002

Thermogravimetry at 520 °C

Duplicate Determination	Applied sample amount	Mass of the porcelain crucible	Mass porcelain crucible + sample after heating	Mass ash	Ash content	Filler content
	[g]	[g]	[g]	[g]	[%]	[%]
Determination 1	1.4976	39.5292	39.5929	0.0637	4.3	0.0
Determination 2	1.2312	42.2919	42.3422	0.0503	4.1	0.0

Parameter	Content [M%]
Ash content (incl. zinc oxide), with reference to the sample	4.2
Filler content, with reference to the sample [1)]	0.0

[1)] The amount of filler is calculated as difference between the amount of ash and zinc oxide, assuming that the maximum of zinc oxide is 5 % of the total latex foam.

5 Aniline ‡#

Test parameter:

Determination of the aniline content in material samples

Test method:

Method description / Analytics:	LA-LC-103.01_28.05.2014 - extraction - analysis by LC-MS/MS Aniline is an unvalidated parameter.

Test result:

Internal sample number	Content (Material) [mg/kg]	Limit of quantification [mg/kg]
59500-A002	2.2	0.1

Cologne, 03/12/2024

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

Appendix

Sampling sheet

eco-INSTITUT Germany GmbH
Laborprüfung
Laboratory testing

Sampling Sheet

59500-002

*Please fill in all fields. If the fields marked * are not filled in, the test piece cannot be accepted for laboratory testing.*

Please take one sampling sheet for each sample! The sampling instruction must be strictly maintained!

Order by*	Novaya NV Grote Molenstraat 21 8710 Wielsbeke Tel. +32(0)51401431	**Testing laboratory**	eco-INSTITUT Germany GmbH Schanzenstr. 6-20, Carlswerk 1.19 D - 51063 Köln Tel. +49 (0)221 - 931245-0 Fax +49 (0)221 - 931245-33
Name of production company		**Sampling by*** (name, company, phone)	
Name of distribution (if different from production)		**Sampling location***	Novaya Belgium
Name of test sample/ item*	Natural Latex Foam - made from 100% natural latex	**Product type** (e.g. parquet, floor covering)	
Article number	87871	**Sample/ Batch***	20739
Model / Program / Series		**Production date of batch***	09/10/2024
Sample taken from	X current production storage other	**Sampling date***	10/10/2024
		Storage conditions before sampling	X open packaged
Storage location		**Packaging material**	

Additional information, if applicable / Special issues
Uncertainties, questions, possible negative effects through emissions at place of sampling - e.g. contaminations during production/storage

VOL BEDRIJFSREVISOREN
Roodbouck Bart
REVISOR

Validation*
By signing the accuracy of the above-mentioned statements **(sampling)** is affirmed.

Date (dd/mm/yyyy) 09/10/2024

Signature

List of calibrated Volatile Organic Compounds (VOC)

Aromatic hydrocarbons (31)
Benzene[4]
1,2,3-Trimethylbenzene
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
1-Isopropyl-2-methylbenzene
1-Isopropyl-4-methylbenzene
1,2,4,5-Tetramethylbenzene
Ethylbenzene
n-Propylbenzene
Isopropylbenzene (Cumene)[4]
1,3-Diisopropylbenzene
1,4-Diisopropylbenzene
n-Butylbenzene
1-Propenylbenzene (beta-Methylstyrene)
Toluene
2-Ethyltoluene
Vinyltoluene
o-Xylene
m-/p-Xylene
Styrene
Phenylacetylene
2-Phenylpropene (alpha-Methylstyrene)
4-Phenylcyclohexene
1-Phenyloctane
1-Phenyldecane[2]
1-Phenylundecane[2]
Indene
Naphthalene
1-Methylnaphthalene
2-Methylnaphthalene
1,4-Dimethylnaphthalene

Aliphatic hydrocarbons (23)
2-Methylpentane[1]
3-Methylpentane[1]
Methylcyclopentane
n-Hexane
Cyclohexane
Methylcyclohexane
1,4-Dimethylcyclohexane
n-Heptane
2,2,4,6,6-Pentamethylheptane
n-Octane
n-Nonane
n-Decane
n-Undecane
n-Dodecane
n-Tridecane
n-Tetradecane
n-Pentadecane
n-Hexadecane
Decahydronaphthalene
1-Octene
1-Decene
1-Dodecene
4-Vinylcyclohexene

Terpenes (12)
delta-3-Carene
alpha-Pinene
beta-Pinene
alpha-Terpinene
Longipinene
Limonene
Longifolene
Isolongifolene
beta-Caryophyllene
alpha-Phellandrene
Myrcene
Camphene

Aliphatic alcohols and ether (18)
Ethanol[1]
1-Propanol[1]
2-Propanol[1]
2-Methyl-1-propanol
1-Butanol
tert-Butanol
1-Pentanol
1-Hexanol
Cyclohexanol
2-Ethyl-1-hexanol
1-Heptanol
1-Octanol
1-Nonanol
1-Decanol
1,4-Cyclohexandimethanol
4-Hydroxy-4-methyl-pentan-2-one (Diacetone alcohol)
Methyl-tert-butyl ether (MTBE)[1]
Tetrahydrofuran (THF)

Aromatic alcohols (phenoles) (8)
Furfuryl alcohol
Benzyl alcohol
Phenol
2-Phenylphenol (oPP)
BHT (2,6-Di-tert-butyl-4-methylphenol)
o-Cresol
m-/p-Cresol
4-Chloro-3-methylphenol (Chlorocresol)

Glycols, Glycol ether, Glycol ester (49)
Ethyleneglycol (Ethan-1,2-diol)
Propylenglycol (Propane-1,2-diol)
Diethylene glycol
Dipropylene glycol
Neopentyl glycol
Hexyleneglycol
Ethyldiglycol
Ethylene glycol monobutyl ether
Diethylene glycol methyl ether
Diethylene glycol monobutyl ether
Diethylene glycol phenyl ether
Dipropylene glycol-dimetyl ether
Dipropylene glycol mono-n-butyl ether
Dipropylene glycol mono-tert-butyl ether
Dipropylene glycol monomethyl ether
Dipropylene glycol mono-n-propyl ether
Tripropylene glycol monomethyl ether
Triethylene glycol dimethyl ether
1,2-Propylene glycol dimethyl ether
1,2-Propylene glycol-n-propyl ether
1,2-Propylene glycol-n-butyl ether
Butyl glycolate
2-Methoxyethanol
2-Ethoxyethanol
2-Methylethoxyethanol
2-Propoxyethanol
2-Hexoxyethanol
2-(2-Hexoxyethoxy)ethanol
2-Phenoxyethanol
1-Methoxy-2-propanol
2-Methoxy-1-propanol
1-Ethoxy-2-propanol
1-tert-Butoxy-2-propanol
3-Methoxy-1-butanol
1,4-Butanediol
1,2-Dimethoxyethane
1,2-Diethoxyethane
1-Methoxy-2-(2-methoxy-ethoxy)ethane
Ethylene carbonate
Propylene carbonate
2-Methoxy-1-propyl acetate
Diethylene glycol monomethyl ether acetate
2-Methoxyethyl acetate
2-Ethoxyethyl acetate
2-Butoxy ethyl acetate
Dipropylene glycol monomethyl ether acetate
Propylene glycol diacetate
Texanol
TXIB (Texanol isobutyrate)

Aldehydes (26)
Formaldehyde[1,3,4]
Acetaldehyde[1,3,4]
Propanal[1,3]
Butanal[1,3]
3-Methyl-1-butanal
Pentanal
Hexanal
2-Ethylhexanal
Heptanal
Octanal
Nonanal
Decanal
Propenal (Acrolein)[1]
Isobutenal (Methacrolein)[3]
2-Butenal
2-Pentenal[3]
2-Hexenal
2-Heptenal
2-Octenal

2-Nonenal
2-Decenal
2-Undecenal
Ethanedial (Glyoxal)[1,3]
Glutaraldehyde
Furfural
Benzaldehyde

Ketones (15)
Acetone[1,3]
1-Hydroxyacetone
Ethylmethylketone[3]
Methylisobutylketone
3-Methyl-2-butanone
Cyclopentanone
2-Methylcyclopentanone
Cyclohexanone
2-Methylcyclohexanone
2-Hexanone
2-Heptanone
Acetophenone
Isophorone
Benzophenone[4]
4-Methylbenzophenone[2]

Acids (11)
Acetic acid
Propionic acid
Pivalic acid
Butyric acid
Isobutyric acid
n-Valeric acid
n-Caproic acid
2-Ethylhexanoic acid
n-Heptanoic acid
n-Octanoic acid
Neodecanoic acid

Esters and Lactones (33)
Methyl acetate[1]
Ethyl acetate[1]
Vinyl acetate[1]
Propyl acetate
Isopropyl acetate
2-Methoxy-1-methylethyl acetate
n-Butyl acetate
Isobutylacetate
2-Ethylhexyl acetate
n-Butyl formate
Methyl acrylate
Methyl methacrylate
Butyl methacrylate
Ethyl acrylate
n-Butyl acrylate
2-Ethylhexyl acrylate
2-Ethylhexyl methacrylate
Hexanediol diacrylate
Dipropylene glycol diacrylate
Dimethyl succinate
Dimethyl glutarate
Dimethyl adipate
Dibutyl fumarate
Dibutyl maleate
Diisobutyl succinate
Diisobutyl glutarate
Butyrolactone
Dimethyl phthalate
Diethyl phthalate[2]
Dipropyl phthalate[2]
Dibutyl phthalate[2]
Diisobutyl phthalate[2]
(5-Ethyl-1,3-dioxan-5-yl)methyl acrylate

Chlorinated hydrocarbons (18)
Dichloromethane[1]
Trichloromethane (Chloroform)[4]
Tetrachloromethane
1,2-Dichloroethane[4]
1,1,1-Trichloroethane
2-Chloropropane
1,2,3-Trichloropropane[4]
Trichloroethene[4]
Tetrachloroethene
trans-1,3-Dichloropropene[4]
cis-1,3-Dichloropropene[4]
Chloroprene[4]
1,3-Dichloro-2-propanol[4]
Chlorobenzene
1,4-Dichlorobenzene
alpha-Chlorotoluene[4]
alpha,alpha,alpha-Trichlorotoluene[4]
1,1-Dichlorethene[1]

Cyclic siloxanes (5)
Hexamethylcyclotrisiloxane (D3)
Octamethylcyclotetrasiloxane (D4)
Decamethylcyclopentasiloxane (D5)
Dodecamethylcyclohexasiloxane (D6)
Tetradecamethylcycoheptasiloxane (D7)

Others (42)
1,4-Dioxane[4]
1,2-Dibromoethane[4]
2-Nitropropane[4]
2,3-Dinitrotoluene[4]
2,4-Dinitrotoluene[4]
2,6-Dinitrotoluene[4]
3,4-Dinitrotoluene[2,4]
o-Anisidine[4]
o-Toluidine[4]
4-Chloro-o-toluidine[4]
5-Nitro-o-toluidine[2]
Acrylonitrile[1,4]
2,2'-Azobisisobutyronitrile
Tetramethylsuccinonitrile
Azobenzene[2,4]
Caprolactam
Furan1,4
2-Methylfuran
2-Pentylfuran
Methenamine
Triethylamine
2-Butanonoxime[4]
Triethyl phosphate
Tributyl phosphate[2]
5-Chloro-2-methyl-4-isothiazolin-3-one (CIT)
2-Methyl-4-isothiazolin-3-one (MIT)
2-n-Octyl-4-isothiazolin-3-one (OIT)
Formamide
Dimethylformamide (DMF)
Acetamide
N-Nitrosopyrrolidine[4]
N-Methyl-2-pyrrolidone
N-Ethyl-2-pyrrolidone
N-Butyl-2-pyrrolidone
Aniline[5]
4-Chloroaniline[4]
2-Nitroanisole[4]
Cyclohexyl isocyanate
p-Cresidine[4]
Diethyl sulfate[4]
Epichlorohydrin[4]
5-Ethyl-1,3-dioxan-5-methanol

1 VVOC
2 SVOC
3 Analysis acc. to DIN ISO 16000-3:2023-12 (DNPH)
4 Carcinogens, category 1A and 1B according to Regulation (EC) No 1272/2008 and TRGS 905
5 When analysing with TD-GC-MS, aniline can occur as a thermal decomposition product of other substances (e.g. 1,3-Diphenylguanidine). A cold analytical method is recommended to confirm the result.

(Status: August 2024)

Definition of terms

CAS No. (Chemical Abstracts Service)	International designation standard for chemical substances
CMR	VOCs, VVOCs and SVOCs classified as carcinogenic, mutagenic or toxic for reproduction according to Regulation (EC) No. 1272/2008, TRGS 905, IARC list and DFG (MAK list)
Limit of quantification (LOQ)	Lower limit of quantification in the analytical method within the defined measurement uncertainty
NIK / LCI	Lowest concentration of interest; substance-specific value for health assessment of emissions from products, indicated in µg/m³
RT (retention time)	Total time required for an analyte to pass the column (time between injection and detection of the analyte)
R value	Sum of quotients of concentration and LCI value for all substances for which a LCI value is derived
R value according to AgBB	R-value for all substances ≥ 5 µg/m³ with LCI value, calculated according to the LCI list of the AgBB scheme
R-value according to Belgian regulation	R-value for all substances ≥ 5 µg/m³ with LCI-value, calculated according to the LCI-list of the Belgian regulation
R value according to eco-INSTITUT-Label	R-value for all substances ≥ 1 µg/m³ with LCI value, calculated according to the LCI list of the AgBB scheme
R value according to EU-LCI	R-value for all substances ≥ 5 µg/m³ with EU-LCI value, calculated according to the EU-LCI list of the European Commission
SER	Specific emission rate (see "Explanation of Specific Emission Rate SER")
SVOC (semi volatile organic compound)	Organic compound eluting in the retention range > C_{16} (n-hexadecane) to C_{22} (docosane)
Toluene equivalent	Concentration of a substance quantified by the TIC response factor of toluene (calculation of the concentration by comparing the integral of the substance with the integral of toluene)
TSVOC	Sum of the concentrations of all identified and unidentified semi volatile organic compounds eluting in the retention range > C_{16} (n-hexadecane) to C_{22} (docosane)
TSVOC according to DIN EN 16516	Sum of all SVOC ≥ 5 µg/m³ (as toluene equivalent)
TSVOC with LCI according to AgBB	Sum of all SVOC with LCI ≥ 5 µg/m³ (quantified substance-specific)
TSVOC with LCI according to eco-INSTITUT-Label	Sum of all SVOC with LCI ≥ 1 µg/m³ (quantified substance-specific)
TSVOC without LCI according to AgBB	Sum of all SVOC without LCI ≥ 5 µg/m³ (as toluene equivalent)
TSVOC without LCI according to eco-INSTITUT label	Sum of all calibrated SVOC without LCI ≥ 1 µg/m³ (quantified substance-specific) and all non-calibrated SVOC without LCI ≥ 1 µg/m³ (as toluene equivalent)
TVOC	Sum of the concentrations of all identified and unidentified volatile organic compounds eluting in the retention range from C_6 (n-hexane) to C_{16} (n-hexadecane)

TVOC according to DIN EN 16516	Sum of all VOC ≥ 5 µg/m³ in the retention range C_6 to C_{16}, calculated as toluene equivalent (used i.a. for M1)
TVOC according to AgBB	Sum of all VOCs with LCI ≥ 5 µg/m³ (quantified substance-specific) and all VOCs without LCI ≥ 5 µg/m³ (as toluene equivalent) (used i.a. for the Blue Angel)
TVOC according to eco-INSTITUT-Label	Sum of all calibrated VOC ≥ 1 µg/m³ (quantified substance-specific) and all non-calibrated VOC ≥ 1 µg/m³ (as toluene equivalent) (used i.a. for natureplus)
TVOC according to ISO 16000-6	Total area of the chromatogram in the retention range C_6 – C_{16} as toluene equivalent according to DIN ISO 16000-6, Annex A.1 item 3 (used i.a. for CDPH, BIFMA and the French VOC regulation)
TVOC without LCI according to AgBB	Sum of all VOCs without LCI ≥ 5 µg/m³ as toluene equivalent
TVOC without LCI according to eco-INSTITUT-Label	Sum of all calibrated VOCs without LCI ≥ 1 µg/m³ (quantified substance-specific) and all non-calibrated VOCs without LCI ≥ 1 µg/m³ (as toluene equivalent)
TVVOC	Sum of the concentrations of all identified and unidentified very volatile organic compounds eluting in the retention range < C_6 (n-hexane)
TVVOC according to AgBB	Sum of all VVOC with LCI ≥ 5 µg/m³ (quantified substance-specificic) and all VVOC without LCI ≥ 5 µg/m³ (as toluene equivalent)
TVVOC according to eco-INSTITUT-Label	Sum of all calibrated VVOC ≥ 1 µg/m³ (substance-specific quantified) and all non-calibrated VVOC ≥ 1 µg/m³ (as toluene equivalent)
VOC (volatile organic compound)	Organic compound eluting in the retention range from C_6 (n-hexane) to C_{16} (n-hexadecane)
VVOC (very volatile organic compound)	Organic compound eluting in the retention range < C_6 (n-hexane)

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. Standardised 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 at an air flow rate of 100 mL/min on Tenax and approx. 100 L at an air flow rate of 0.8 L/min on silica gel coated with DNPH (2,4-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 derivatised with DNPH for the determination of formaldehyde and other short-chain carbonyl compounds (C_1 - C_6) are analysed using high-performance liquid chromatography (HPLC).

Over 200 compounds, including volatile organic compounds (C_6 - C_{16}), semi-volatile organic compounds (C_{16} - C_{22}) and – insofar as possible with this method – also very volatile organic compounds (less than C_6) are determined and quantified individually.

All other substances – insofar as 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 toluene.

The determined substance concentrations are corrected using the recovery rate of the internal standard (toluene-d8). Identification and quantification of substances is carried out from a concentration (limit of quantification) of 1 µg per m³ test chamber air or 2 µg/m³ for DNPH-derivatised substances. In the case of highly loaded samples, the evaluation limit of non-calibrated substances is raised in some cases, as it is no longer possible to assign individual, small signals due to the large number of signals.

Quality assurance

The eco-INSTITUT Germany GmbH is granted flexible scope of accreditation pursuant to DIN EN ISO/IEC 17025:2018-03. 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 16516:2020-10. 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.

The expanded measurement uncertainty U for the analytical determination of all volatile organic compounds, including the test chamber method, is estimated to 41.7 %. The calculation is based on DIN ISO 11352:2013-03 (Nordtest).

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.

$$SER = q \cdot c$$

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.