

Roland DG Corporation Miyakoda Plant
1-1-3 ShinMiyakoda, Kita-ku, Hamamatsu-shi,
431-2103 Shizuoka
Japan

Test Report No. 58158-A001-AgBB-L

Test objective:	Evaluation according to AgBB scheme 2021
Article designation according to order:	AP-640_W76451 Printing Sample
Date of report:	10/05/2023
Number of pages of report:	21
Testing / responsible laboratory:	eco- INSTITUT Germany GmbH, Köln
Test objective fulfilled:	✓
Note:	The test results in the report refer exclusively to the test sample submitted by the manufacturer. The report is not permitted to be used in product and company advertising. The report may be published in full as technical documentation on the Internet with the written consent of eco- INSTITUT Germany GmbH. eco- INSTITUT Germany GmbH has recommended that the manufacturer repeats the test after 3 years at the latest. More information at www.eco-institut.de/en/advertising



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Sample View

Internal sample number (filled in by laboratory)

58158-A001

Photo of the test sample:

A001



Article designation according to order:

AP-640_W76451 Printing Sample

Sample/batch number according to order:

Sample printed by inkjet printer (AP-640)

Type of sample:

wall covering

Date of production:

15/03/2023

Sampling by:

Tetsunori Niyama, Roland DG Corporation

Date of sampling:

15/03/2023

Location of sampling:

1-1-3 Shinmiyakoda, Kitaku 431-2103 Hamamatsu-Shi

Receipt of sample / Condition upon delivery:

20/03/2023 / without objection

Statement of conformity with AgBB 2021

The sample with the internal sample number 58158-A001 has been tested on behalf of **Roland DG Corporation Miyakoda Plant**. The article description according to the order is **AP-640_W76451 Printing Sample**.

This evaluation is based on the test criteria of the scheme “Health-related Evaluation of Emissions of Volatile Organic Compounds (VVOC, VOC and SVOC) from Building Products” of the Committee for Health-Related Evaluation of Building Products (AgBB 2021).

The results documented in the test report were evaluated as follows.¹

Test parameter	Result	Requirement	Requirement hold [yes/no]
Emission analysis			
Measurement time: 3 days after test chamber loading			
Sum VOC (C6-C16) ¹⁾	0.85 mg/m ³	≤ 10 mg/m ³	yes
Carcinogenic substances, cat. 1A and 1B acc. to Regulation (EC) No. 1272/2008 (and TRGS 905) (per substance)	≤ 0.01 mg/m ³	≤ 0.01 mg/m ³	yes
Measurement time: 28 days after test chamber loading			
Sum VOC (C6-C16) including SVOC with LCI ¹⁾	0.22 mg/m ³	≤ 1.0 mg/m ³	yes
Sum SVOC without LCI (C ₁₆ -C ₂₂) ¹⁾	< 0.005 mg/m ³	≤ 0.1 mg/m ³	yes
R-value (dimensionless)	0.15	≤ 1	yes
Sum VOC without LCI	0.11 mg/m ³	≤ 0.1 mg/m ³	yes ²⁾
Carcinogenic substances, cat. 1A and 1B acc. to Regulation (EC) No. 1272/2008 (and TRGS 905) (per substance)	≤ 0.001 mg/m ³	≤ 0.001 mg/m ³	yes

1) For sum VOC (C₆-C₁₆) and sum SVOC (C₁₆-C₂₂) only substances ≥ 5 µg/m³ are considered.

2) Requirement hold due to the rounding specifications to one significant digit.

¹ If a measurement result that slightly exceeds the specification is assessed as “not fulfilled”, this is based on the agreement of the “shared risk of measurement uncertainty (shared risk approach)”. According to this, the probability that the statement is correct is ≥ 50 %. Similarly, a result slightly below the specification value also only has a probability of ≥ 50 % of being compliant. I.e., the risk of making a false negative statement regarding the fulfilment of the specification is just as high as the risk of making a false positive statement (more information at https://www.eco-institut.de/en/2019/07/measurement_uncertainty/).



Summary statement of conformity with AgBB 2021

The sample with the internal sample number 58158-A001, article description according to order: AP-640_W76451 Printing Sample, meets the emission requirements of the AgBB scheme.

Cologne, 10/05/2023

A handwritten signature in black ink, appearing to read 'M.A. Dobaj', is positioned below the date.

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

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

A001, Preparation of test sample

Date: 31/03/2023
Sample preparation: not applicable; transfer of the test specimen into the test chamber immediately
Masking of backside: yes
Masking of edges: no
Relationship of unmasked edges to surface: not applicable
Loading reference unit: area-specific [m²]
Dimensions: 35.3 cm x 35.3 cm

A001, Test chamber conditions according to DIN EN ISO 16000-9:2008-04

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: 1.0 m²/m³
Specific air flow rate: 0.5 m³/(m² · h)
Starting time of the test (t₀): 31/03/2023
Air sampling: 3 days after test chamber loading
28 days after test chamber loading

Analytics

Aldehydes and ketones | DIN ISO 16000-3:2013-01
Limit of quantification: 2 µg/m³
Volatile organic compounds | DIN ISO 16000-6:2022-03
Limit of quantification: 1 µg/m³ (1,4-Cyclohexanedimethanol, Diethylene glycol, 1,4-Butanediol: 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:

Internal sample number: | 58158-A001

No.	Substance	CAS No.	RT [min]	Concentration+ calib. substances ≥ 1 µg/m ³ uncalib. substances ≥ 1 µg/m ³ DNPH ≥ 2 µg/m ³ [µg/m ³]	Toluene- equivalent substances ≥ 5 µg/m ³ [µg/m ³]	CMR Classifi- cation++	LCI AgBB 2021 [µg/m ³]	R-value
4	Aliphatic mono alcohols (n-, iso-, cyclo-) and dialcohols							
4-6	1-Butanol	71-36-3	5.65	4	< 5		3000	0.00
4-10	2-Ethyl-1-hexanol	104-76-7	13.24	14	14		300	0.05
6	Glycols, Glycol ethers, Glycol esters							
6-1	Propylene glycol (Propane-1,2-diol)	57-55-6	7.16	500	190		2100	0.24
6-2	Ethylene glycol (Ethane-1,2-diol)	107-21-1	6.35	5	< 5		3400	0.00
6-3	Ethylene glycol monobutyl ether (2-Butoxyethanol)	111-76-2	10.54	2	< 5	Group 3	1600	0.00
6-28	Dipropylene glycol	110-98-5	13.15	19	< 5		670	0.03
6-38	Ethylidiglycol, (Diethylene glycol monoethyl ether, 2-(2-Ethoxyethoxy)ethanol)	111-90-0	12.62	8	< 5		350	0.02
7	Aldehydes							
7-2	Pentanal (Valeraldehyde)	110-62-3	6.27	3	< 5		800	0.00
7-19	Benzaldehyde	100-52-7	12.16	1	< 5		90	0.01
7-20	Acetaldehyde	75-07-0		4	n. d.	Carc. 1B Muta. 2	300	0.01
7-22	Formaldehyde	50-00-0		8	n. d.	Carc. 1B Muta. 2	100	0.08
10	Esters							
10-12	2-Ethylhexyl acetate	103-09-3	15.64	8	8		350	0.02
10-16	2-Ethylhexyl acrylate	103-11-7	17.30	19	18	Group 2B	380	0.05
12	Others							
12-4	Octamethylcyclotetrasiloxane (D4)	556-67-2	11.76	1	< 5	Repr. 2	1200	0.00

No.	Substance	CAS No.	RT [min]	Concentration+	Toluene-	CMR Classifi- cation++	LCI	R-value
				calib. substances ≥ 1 µg/m ³ uncalib. substances ≥ 1 µg/m ³ DNPH ≥ 2 µg/m ³ [µg/m ³]	equivalent substances ≥ 5 µg/m ³ [µg/m ³]		AgBB 2021 [µg/m ³]	
13	Other identified substances in addition to LCI list							
	Hexamethylcyclotrisiloxane (D3)	541-05-9	8.26	2	< 5			
	Glycol, m/z 45 59*		12.62	5	5			
	Glycol, pres. 1,2-Hexandiol*		13.6	140	140			
	Glycol, m/z 45 59 72*		14.13	1	< 5			
	2-Pyrrolidon*		14.30	4	< 5			
	m/z 57 70*		17.46	2	< 5			
	Glycols*		19.0 - 21.5	120	120			
	m/z 43 109 151*		21.50	12	12			
	Not ident. SVOC, m/z 43 69 109*		25.08	2	< 5			
	Not ident. SVOC, m/z 55 99 173*		25.61	1	< 5			
	Carboxylic acid, SVOC*		28.54	1	< 5			

+ 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: Kategorie 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 components*	Concentration after 3 days [µg/m ³]	SERa [µg/(m ² · 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	< 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: K1A, K1B (sum)	< 1	< 0.5

TVOC, Total volatile organic compounds	Concentration after 3 days [µg/m ³]	SERa [µg/(m ² · h)]
Sum of VOC according to DIN EN 16516	510	250
Sum of VOC according to AgBB 2021	850	430
Sum of VOC according to eco-INSTITUT-Label	870	440
Sum of VOC according to DIN ISO 16000-6	400	200

TSVOC, Total semi volatile organic compounds	Concentration after 3 days [µg/m ³]	SERa [µg/(m ² · h)]
Sum of SVOC according to DIN EN 16516	< 5	< 2.5
Sum of SVOC without LCI according to AgBB 2021	< 5	< 2.5
Sum of SVOC without LCI according to eco-INSTITUT-Label	4	2
Sum of SVOC with LCI according to AgBB 2021	< 5	< 2.5

TVVOC, Total very volatile organic compounds	Concentration after 3 days [µg/m ³]	SERa [µg/(m ² · h)]
Sum of VVOC according to AgBB 2021	8	4
Sum of VVOC according to eco-INSTITUT-Label	12	6

*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 3 days [µg/m³]	SERa [µg/(m² · h)]
VOC without LCI according to AgBB 2021 (sum)	280	140
VOC without LCI according to eco-INSTITUT-Label (sum)	290	140
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)	32	16
Sensitising compounds with the following categorisations: DFG (MAK list): Category IV; Regulation (EC) No. 1272/2008: skin sensitising, respiratory sensitising; TRGS 907 (sum)	30	15
Bicyclic Terpenes (sum)	< 1	< 0.5
C9 - C14 Alkanes / Isoalkanes as dekane-equivalent (sum)	< 1	< 0.5
C4 - C11 Aldehydes, acyclic, aliphatic (sum)	3	1.5
C9 - C15 Alkylated benzenes (sum)	< 1	< 0.5
Cresols (sum)	< 1	< 0.5

Risk value for assessment of LCI	R-value
R-value according to eco-INSTITUT-Label	0.52
R-value according to AgBB 2021	0.49
R-value according to Belgian regulation	0.49
R-value according to EU-LCI	0.49

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 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:

Internal sample number: | 58158-A001

No.	Substance	CAS No.	RT [min]	Concentration+ calib. substances ≥ 1 µg/m ³ uncalib. substances ≥ 1 µg/m ³ DNPH ≥ 2 µg/m ³ [µg/m ³]	Toluene- equivalent substances ≥ 5 µg/m ³ [µg/m ³]	CMR Classifi- cation++	LCI AgBB 2021 [µg/m ³]	R-value
4	Aliphatic mono alcohols (n-, iso-, cyclo-) and dialcohols							
4-6	1-Butanol	71-36-3	6.28	2	< 5		3000	0.00
4-10	2-Ethyl-1-hexanol	104-76-7	14.04	4	< 5		300	0.01
6	Glycols, Glycol ethers, Glycol esters							
6-1	Propylene glycol (Propane-1,2-diol)	57-55-6	7.53	100	50		2100	0.05
6-38	Ethylidiglycol, (Diethylene glycol monoethyl ether, 2-(2-Ethoxyethoxy)ethanol)	111-90-0	13.39	1	< 5		350	0.00
7	Aldehydes							
7-20	Acetaldehyde	75-07-0		2	n. d.	Carc. 1B Muta. 2	300	0.01
7-22	Formaldehyde	50-00-0		9	n. d.	Carc. 1B Muta. 2	100	0.09
8	Ketones							
8-10	Acetone	67-64-1		3	n. d.		120000	0.00
10	Esters							
10-12	2-Ethylhexyl acetate	103-09-3	16.47	2	< 5		350	0.01
10-16	2-Ethylhexyl acrylate	103-11-7	18.25	6	6	Group 2B	380	0.02



No.	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]	CMR Classifi- cation++	LCI AgBB 2021 [µg/m³]	R-value
13	Other identified substances in addition to LCI list							
	Glycol, pres. 1,2-Hexandiol*		14.21	14	14			
	Glycols*		20.2- 21.3	93	93			
	m/z 43 109 151*		22.39	5	5			
	Not ident. SVOC, m/z 43 69 109*		25.80	1	< 5			

+ 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: Kategorie 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 components*	Concentration after 28 days [µg/m ³]	SERa [µg/(m ² · 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	< 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: K1A, K1B (sum)	< 1	< 0.5

TVOC, Total volatile organic compounds	Concentration after 28 days [µg/m ³]	SERa [µg/(m ² · h)]
Sum of VOC according to DIN EN 16516	170	84
Sum of VOC according to AgBB 2021	220	110
Sum of VOC according to eco-INSTITUT-Label	230	110
Sum of VOC according to DIN ISO 16000-6	210	110

TSVOC, Total semi volatile organic compounds	Concentration after 28 days [µg/m ³]	SERa [µg/(m ² · h)]
Sum of SVOC according to DIN EN 16516	< 5	< 2.5
Sum of SVOC without LCI according to AgBB 2021	< 5	< 2.5
Sum of SVOC without LCI according to eco-INSTITUT-Label	1	0.5
Sum of SVOC with LCI according to AgBB 2021	< 5	< 2.5

TVVOC, Total very volatile organic compounds	Concentration after 28 days [µg/m ³]	SERa [µg/(m ² · h)]
Sum of VVOC according to AgBB 2021	9	4.5
Sum of VVOC according to eco-INSTITUT-Label	14	7

*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 28 days [µg/m³]	SERa [µg/(m² · h)]
VOC without LCI according to AgBB 2021 (sum)	110	56
VOC without LCI according to eco-INSTITUT-Label (sum)	110	56
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)	17	8.5
Sensitising compounds with the following categorisations: DFG (MAK list): Category IV; Regulation (EC) No. 1272/2008: skin sensitising, respiratory sensitising; TRGS 907 (sum)	15	7.5
Bicyclic Terpenes (sum)	< 1	< 0.5
C9 - C14 Alkanes / Isoalkanes as dekane-equivalent (sum)	< 1	< 0.5
C4 - C11 Aldehydes, acyclic, aliphatic (sum)	< 2	< 1
C9 - C15 Alkylated benzenes (sum)	< 1	< 0.5
Cresols (sum)	< 1	< 0.5

Risk value for assessment of LCI	R-value
R-value according to eco-INSTITUT-Label	0.18
R-value according to AgBB 2021	0.15
R-value according to Belgian regulation	0.15
R-value according to EU-LCI	0.16

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.

Cologne, 10/05/2023



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



Appendix

Sampling sheet



Sampling Sheet

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

58158-001

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

Customer*	Roland DG Corporation Miyakoda Plant	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 manufacturer		Sampler*	Tetsunori Niyama Roland DG Corporation +81(0)53 484 1210
Name of distributor (if different from customer)		Sampling location*	1-1-3 Shinmiyakoda, Kitaku 431-2103 HAMAMATSU-SHI
Name of test sample/item*	AP-640_W76451 Printing Sample	Product type (e.g. parquet, floor covering)	wall covering
Article number		Sample/Batch*	Sample printed by inkjet printer (AP-640)
Model / Program / Series	Printer:AP-640, Ink:TA-CY, MG, YE, BK, OP,	Production date of batch*	March 15, 2023
Sample were taken from	<input checked="" type="checkbox"/> current production <input type="checkbox"/> storage <input type="checkbox"/> other	Sampling date*	March 15, 2023
Storage location		Storage conditions before sampling	<input type="checkbox"/> open <input type="checkbox"/> packaged
Storage location		Packaging material	
Special issues / Additional information, if applicable	Uncertainties, questions, possible negative effects through emissions at place of sampling - e.g. contaminations during production / storage	FYI - "AP-640_2517 Printing Sample" and "AP-640_W76451 Printing Sample" use same printer and same ink, but they are different in media (substrate) .	
Validation*	Hereby the signer (sampler) affirms the accuracy of the above-mentioned statements.		
Date (yyyy/mm/dd)	2023/03/15	Signature Sampler	<i>Tetsunori Niyama</i>

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 Tel. +49 221.931245-0 / Fax +49 221.931245-33 / eco-institut.de / Geschäftsführer: Dr. Frank Kuebart, Daniel Tigges
 HRB 17917 / USt-ID: DE 122653308 / Volksbank Rhein-Erft-Köln eG, IBAN: DE60370623651701900010, BIC: GENODE33HAN

Remark: It is not permitted to publish extracts of this report and the comments on the first page of this report apply.

List of calibrated Volatile Organic Compounds (VOC)

Aromatic hydrocarbons (31)

Benzene⁴
 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)
 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-Phenylcyclohexane
 1-Phenyldecane²
 1-Phenylundecane²
 Indene
 Naphthalene
 1-Methylnaphthalene
 2-Methylnaphthalene
 1,4-Dimethylnaphthalene

Aliphatic hydrocarbons (23)

2-Methylpentane¹
 3-Methylpentane¹
 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)

Ethanol¹
 1-Propanol¹
 2-Propanol¹
 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-dimethyl 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)^{1,3}
 Isobutanal (Methacrolein)³
 2-Butenal³
 2-Pentenal³
 2-Hexenal
 2-Heptenal
 2-Octenal



2-Nonenal	Methyl acrylate	Others (41)
2-Decenal	Methyl methacrylate	1,4-Dioxane ⁴
2-Undecenal	Butyl methacrylate	1,2-Dibromoethane ⁴
Ethanedial (Glyoxal) ^{1,3}	Ethyl acrylate	2-Nitropropane ⁴
Glutaraldehyde	n-Butyl acrylate	2,3-Dinitrotoluene ⁴
Furfural	2-Ethylhexyl acrylate	2,4-Dinitrotoluene ⁴
Benzaldehyde	Hexanediol diacrylate	2,6-Dinitrotoluene ⁴
Ketones (14)	Dipropylene glycol diacrylate	3,4-Dinitrotoluene ^{2,4}
Acetone ^{1,3}	Dimethyl succinate	o-Anisidine ⁴
1-Hydroxyacetone	Dimethyl glutarate	o-Toluidine ⁴
Ethylmethylketone ³	Dimethyl adipate	4-Chloro-o-toluidine ⁴
Methylisobutylketone	Dibutyl fumarate	5-Nitro-o-toluidine ²
3-Methyl-2-butanone	Dibutyl maleate	Acrylonitrile ^{1,4}
Cyclopentanone	Diisobutyl succinate	2,2'-Azobisisobutyronitrile
2-Methylcyclopentanone	Diisobutyl glutarate	Tetramethylsuccinonitrile
Cyclohexanone	Butyrolactone	Azobenzene ^{2,4}
2-Methylcyclohexanone	Dimethyl phthalate	Caprolactam
2-Hexanone	Diethyl phthalate ²	Furan ^{1,4}
2-Heptanone	Dipropyl phthalate ²	2-Methylfuran
Acetophenone	Dibutyl phthalate ²	2-Pentylfuran
Isophorone	Diisobutyl phthalate ²	Methenamine
Benzophenone ²		Triethylamine
Acids (11)	Chlorinated hydrocarbons (17)	2-Butanoneoxime ⁴
Acetic acid	Dichloromethane ¹	Triethyl phosphate
Propionic acid	Trichloromethane (Chloroform) ⁴	Tributyl phosphate ²
Pivalic acid	Tetrachloromethane	5-Chloro-2-methyl-4-isothiazolin-3-one (CIT)
Butyric acid	1,2-Dichloroethane ⁴	2-Methyl-4-isothiazolin-3-one (MIT)
Isobutyric acid	1,1,1-Trichloroethane	2-n-Octyl-4-isothiazolin-3-one (OIT) ^{2,4}
n-Valeric acid	2-Chloropropane	Formamide
n-Caproic acid	1,2,3-Trichloropropane ⁴	Dimethylformamide (DMF)
2-Ethylhexanoic acid	Trichloroethene ⁴	Acetamide
n-Heptanoic acid	Tetrachloroethene	N-Nitrosopyrrolidine ⁴
n-Octanoic acid	trans-1,3-Dichloropropene ⁴	N-Methyl-2-pyrrolidone
Neodecanoic acid	cis-1,3-Dichloropropene ⁴	N-Ethyl-2-pyrrolidone
Esters and Lactones (31)	Chloroprene ⁴	N-Butyl-2-pyrrolidone
Methyl acetate ¹	1,3-Dichloro-2-propanol ⁴	Aniline
Ethyl acetate ¹	Chlorobenzene	4-Chloroaniline ⁴
Vinyl acetate ¹	1,4-Dichlorobenzene	2-Nitroanisole ⁴
Propyl acetate	alpha-Chlorotoluene ⁴	Cyclohexyl isocyanate
Isopropyl acetate	alpha,alpha,alpha-Trichlorotoluene ⁴	p-Cresidine ⁴
2-Methoxy-1-methylethyl acetate		Diethyl sulfate ⁴
n-Butyl acetate	Cyclic siloxanes (5)	Epichlorohydrin ⁴
Isobutylacetate	Hexamethylcyclotrisiloxane (D3)	
2-Ethylhexyl acetate	Octamethylcyclotetrasiloxane (D4)	
n-Butyl formate	Decamethylcyclopentasiloxane (D5)	
	Dodecamethylcyclohexasiloxane (D6)	
	Tetradecamethylcycoheptasiloxane (D7)	

1 VVOC

2 SVOC

3 Analysis acc. to DIN ISO 16000-3:2013-01 (DNPH)

4 Carcinogens, category 1A and 1B according to Regulation (EC) No 1272/2008 and TRGS 905

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)
NIK / LCI	Lowest concentration of interest; substance-specific value for health assessment of emissions from products, indicated in $\mu\text{g}/\text{m}^3$
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 $\geq 5 \mu\text{g}/\text{m}^3$ with LCI value, calculated according to the LCI list of the AgBB scheme
R-value according to Belgian regulation	R-value for all substances $\geq 5 \mu\text{g}/\text{m}^3$ 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 $\geq 1 \mu\text{g}/\text{m}^3$ with LCI value, calculated according to the LCI list of the AgBB scheme
R value according to EU-LCI	R-value for all substances $\geq 5 \mu\text{g}/\text{m}^3$ 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")
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)
VOC (volatile organic compound)	Organic compound eluting in the retention range from C6 (n-hexane) to C16 (n-hexadecane)
TVOC	Sum of the concentrations of all identified and unidentified volatile organic compounds eluting in the retention range from C6 (n-hexane) to C16 (n-hexadecane)
TVOC according to DIN EN 16516	Sum of all VOC $\geq 5 \mu\text{g}/\text{m}^3$ in the retention range C6 to C16, calculated as toluene equivalent (used i.a. for M1)
TVOC according to AgBB	Sum of all VOCs with LCI $\geq 5 \mu\text{g}/\text{m}^3$ (quantified substance-specific) and all VOCs without LCI $\geq 5 \mu\text{g}/\text{m}^3$ (as toluene equivalent) (used i.a. for the Blue Angel)
TVOC according to eco-INSTITUT-Label	Sum of all calibrated VOC $\geq 1 \mu\text{g}/\text{m}^3$ (quantified substance-specific) and all non-calibrated VOC $\geq 1 \mu\text{g}/\text{m}^3$ (as toluene equivalent) (used i.a. for natureplus)
TVOC according to ISO 16000-6	Total area of the chromatogram in the retention range C6 – C16 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 $\geq 5 \mu\text{g}/\text{m}^3$ as toluene equivalent
TVOC without LCI according to eco-INSTITUT-Label	Sum of all calibrated VOCs without LCI $\geq 1 \mu\text{g}/\text{m}^3$ (quantified substance-specific) and all non-calibrated VOCs without LCI $\geq 1 \mu\text{g}/\text{m}^3$ (as toluene equivalent)
VVOC (very volatile organic compound)	Organic compound eluting in the retention range $< \text{C6}$ (n-hexane)

TVOC	Sum of the concentrations of all identified and unidentified very volatile organic compounds eluting in the retention range < C6 (n-hexane)
TVOC according to AgBB	Sum of all VVOC with LCI $\geq 5 \mu\text{g}/\text{m}^3$ (quantified substance-specific) and all VVOC without LCI $\geq 5 \mu\text{g}/\text{m}^3$ (as toluene equivalent)
TVOC according to eco-INSTITUT-Label	Sum of all calibrated VVOC $\geq 1 \mu\text{g}/\text{m}^3$ (substance-specific quantified) and all non-calibrated VVOC $\geq 1 \mu\text{g}/\text{m}^3$ (as toluene equivalent)
SVOC (semi volatile organic compound)	Organic compound eluting in the retention range > C16 (n-hexadecane) to C22 (docosane)
TSVOC	Sum of the concentrations of all identified and unidentified semi volatile organic compounds eluting in the retention range > C16 (n-hexadecane) to C22 (docosane)
TSVOC according to DIN EN 16516	Sum of all SVOC $\geq 5 \mu\text{g}/\text{m}^3$ (as toluene equivalent)
TSVOC without LCI according to AgBB	Sum of all SVOC without LCI $\geq 5 \mu\text{g}/\text{m}^3$ (as toluene equivalent)
TSVOC with LCI according to AgBB	Sum of all SVOC with LCI $\geq 5 \mu\text{g}/\text{m}^3$ (quantified substance-specific)
TSVOC without LCI according to eco-INSTITUT label	Sum of all calibrated SVOC without LCI $\geq 1 \mu\text{g}/\text{m}^3$ (quantified substance-specific) and all non-calibrated SVOC without LCI $\geq 1 \mu\text{g}/\text{m}^3$ (as toluene equivalent)
TSVOC with LCI according to eco-INSTITUT-Label	Sum of all SVOC with LCI $\geq 1 \mu\text{g}/\text{m}^3$ (quantified substance-specific)

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

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 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.

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

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.