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# VOC EMISSION TEST REPORT
# Indoor Air Comfort GOLD®

9 September 2020

## 1 Sample Information

| | |
|---|---|
| Sample name | Perlifoc HP |
| Batch no. | Palet number 42 |
| Production date | 01/07/2020 |
| Product type | Gypsum based mortar |
| Sample reception | 17/07/2020 |

## 2 Brief Evaluation of the Results

| Regulation or protocol | Conclusion | Version of regulation or protocol |
|---|---|---|
| French VOC Regulation | A+ | Regulation of March and May 2011 (DEVL1101903D and DEVL1104875A) |
| French CMR components | Pass | Regulation of April and May 2009 (DEVP0908633A and DEVP0910046A) |
| Italian CAM Edilizia | Pass | Decree 11 October 2017 (GU n.259 del 6-11-2017) |
| AgBB/ABG | Pass | Anforderungen an bauliche Anlagen bezüglich des Gesundheitsschutzes, ABG May 2019, AgBB August 2018 |
| Belgian Regulation | Pass | Royal decree of May 2014 (C-2014/24239) |
| EMICODE | EC 1 PLUS | April 2020 |
| Indoor Air Comfort® | Pass | Indoor Air Comfort 7.0 of May 2020 |
| Indoor Air Comfort GOLD® | Pass | Indoor Air Comfort GOLD 7.0 of May 2020 |
| Blue Angel (DE-UZ 113) | Fail | DE-UZ 113 for “Low-Emission Floor Covering Adhesives and other Installation Materials” (Version January 2019) |
| BREEAM International | Exemplary Level | BREEAM International New Construction v2.0 (2016) |
| BREEAM® NOR | Fail | BREEAM-NOR New Construction v1.2 (2019) |

Full details based on the testing and direct comparison with limit values are available in the following pages

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# 3 Applied Test Methods

## 3.1 General Test References

| Regulation, protocol or standard | Version | Reporting limit VOC [µg/m³] | Calculation of TVOC | Combined uncertainty¤ [RSD(%)] |
|---|---|---|---|---|
| EN 16516 | October 2017 | 5 | Toluene equivalents | 22% |
| ISO 16000 -3 -6 -9 -11 | 2006-2011 depending on part | 2 | Toluene equivalents | 22% |
| ASTM D5116-10 | 2010 | - | - | - |
| Specifications Indoor Air Comfort Gold | 7.0 of May 2020 | 5 | Toluene equivalents | 22% |
| French VOC Classes | Regulation of March and May 2011 (DEVL1101903D and DEVL1104875A) | 2 | Toluene equivalents | 22% |
| French CMR | Regulation of April and May 2009 (DEVP0908633A and DEVP0910046A) | 1 | Toluene equivalents | 22% |
| Italian CAM Edilizia | Decree 11 October 2017. Section 2.3.5.5 | 2 | Toluene equivalents | 22% |
| AgBB | August 2018 | 5 | Compound Specific | 22% |
| MVV TB/ABG | May 2019 | 5 | Compound Specific | 22% |
| Belgian VOC | Royal decree of May 2014 (C - 2014 / 24239) | 5 | Toluene equivalents | 22% |
| EMICODE | April 2020 | 5 | Toluene equivalents | 22% |
| BREEAM® NOR | BREEAM-NOR New Construction v1.2 (2019) | 5 | Toluene equivalents | 22% |
| BREEAM International | BREEAM International New Construction v2.0 (2016) | - | - | - |
| LEED v4.1 | July 2019 | - | - | - |
| Blue Angel (DE-UZ 113) | January 2019 | 5 | Compound Specific | 22% |

## 3.2 Specific Laboratory Sampling and Analyses

| Procedure | External Method | Internal SOP | Quantification limit / sampling volume | Analytical principle | Uncertainty¤ [RSD(%)] |
|---|---|---|---|---|---|
| Sample preparation | ISO 16000-11:2006, EN16402:2013, CDPH:2017, AgBB:2018, EMICODE:2019 | 71M549810 | - | - | - |
| Emission chamber testing | ISO 16000-9:2006, EN 16516:2017 | 71M549811 | - | Chamber and air control | - |
| Sampling of VOC | ISO 16000-6:2011, EN 16516:2017 | 71M549812 | 5 L | Tenax TA | - |
| Analysis of VOC | ISO 16000-6:2011, EN 16516:2017 | 71M542808B | 1 µg/m³ | ATD-GC/MS | 10% |
| Sampling of aldehydes | ISO 16000-3:2011, EN 16516:2017 | 71M549812 | 35 L | DNPH | - |
| Analysis of aldehydes | ISO 16000-3:2011, EN 717-1:2004, EN 16516:2017 | 71M548400 | 3-6 µg/m³ | HPLC-UV | 10% |
| Sampling of phthalates* | ISO 16000-33:2017, MEL-09:2003 | 71M549812 | 60 L | XAD-2 | - |
| Analysis of phthalates* | ISO 16000-33:2017 | 71M546060 | 0.6 µg/m³ | GC/MS | 10% |

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# 4 Test Parameters, Sample Preparation and Deviations

## 4.1 VOC Emission Chamber Test Parameters

| Parameter | Value | Parameter | Value |
|---|---|---|---|
| Chamber volume, V[L] | 119 | Preconditioning period | - |
| Air Change rate, n[$h^{-1}$] | 0.5 | Test period | 03/08/2020 - 31/08/2020 |
| Relative humidity of supply air, RH [%] | 50 ± 3 | Area specific ventilation rate, q [m/h or $m^3/m^2/h$] | 0.36 |
| Temperature of supply air, T [°C] | 23 ± 1 | Loading factor [$m^2/m^3$] | 1.4 |
| | | Test scenario | Wall and ceiling |

## 4.2 Preparation of the Test Specimen

The sample was mixed homogeneously, 700 g material in 560 g water. A part of the mixture was applied into a flat bottomed petri discs yielding a 3 mm thick layer.

## 4.3 Picture of Sample

## 4.4 Deviations from Referenced Protocols and Regulations

No deviations from the referenced test methods were observed.

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# 5 Results

## 5.1 VOC Emission Test Results after 3 Days

| | CAS No. | Retention time [min] | ID-Cat | Specific Conc. [µg/m³] | Toluene eq. [µg/m³] | Specific SER [µg/(m²·h)] | $R_D$ | $R_B$ |
|---|---|---|---|---|---|---|---|---|
| **VOC with NIK/LCI** | | | | | | | | |
| 1-Butanol | 71-36-3 | 2.51 | 1 | 23 | 7.0 | 8.3 | 0.0078 | 0.0078 |
| 1-Methoxy-2-propanol * | 107-98-2 | 2.62 | 1 | 200 | 72 | 72 | 0.026 | 0.026 |
| Ethylbenzene | 100-41-4 | 6.11 | 1 | 14 | 15 | 5.0 | 0.016 | 0.016 |
| m/p-Xylene * | 179601-23-1 | 6.26 | 1 | 5.6 | 6.1 | 2.0 | 0.011 | 0.011 |
| Other alkylbenzene * | | 7.30 | 2 | 8.2 | 8.2 | 2.9 | 0.018 | 0.018 |
| n-Propylbenzene | 103-65-1 | 7.80 | 1 | 8.3 | 9.8 | 3.0 | 0.0087 | 0.0087 |
| Benzaldehyde [e] | 100-52-7 | 7.91 | 1 | 14 | 12 | 4.9 | 0.15 | 0.15 |
| 2-Ethyl-1-hexanol | 104-76-7 | 8.93 | 1 | 23 | 16 | 8.1 | 0.075 | 0.075 |
| Acetophenone | 98-86-2 | 9.50 | 1 | 38 | 30 | 14 | 0.078 | 0.078 |
| **VOC without NIK/LCI** | | | | | | | | |
| Not identified * | | 2.94 | 4 | 15 | 15 | 5.4 | | |
| 1-Ethoxy-2-propanol * | 1569-02-4 | 3.73 | 2 | 15 | 15 | 5.3 | | |
| **Sum of VOC without NIK/LCI** | | | | 30 | 30 | 11 | | |
| **VVOC compounds** | | | | | | | | |
| None determined | | | | | | | | |
| **TVVOC** | | | | < 5 | < 5 | < 2 | | |
| **SVOC compounds** | | | | | | | | |
| None determined | | | | | | | | |
| **TSVOC** | | | | < 5 | < 5 | < 2 | | |
| **Carcinogens** | | | | | | | | |
| **Total carcinogens** | | | | < 1 | < 1 | < 1 | | |
| **Aldehydes** | | | | | | | | |
| Formaldehyde | 50-00-0 | | 1 | 3.4 | | 1.2 | | |
| Acetaldehyde | 75-07-0 | | 1 | 32 | | 11 | 0.027 | 0.027 |
| Propionaldehyde | 123-38-6 | | 1 | < 3 | | < 2 | | |
| Butyraldehyde | 123-72-8 | | 1 | < 3 | | < 2 | | |
| Acrolein * | 107-02-8 | | 1 | < 5 | | < 2 | | |
| 2-Butenal * | 123-73-9 | | 1 | < 5 | | < 2 | | |
| Glutaraldehyde * | 111-30-8 | | 1 | < 5 | | < 2 | | |
| Octanal * | 124-13-0 | | 1 | < 5 | | < 2 | | |

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| | CAS No. | Retention time [min] | ID-Cat | Specific Conc. [µg/m³] | Toluene eq. [µg/m³] | Specific SER [µg/(m²·h)] | $R_D$ | $R_B$ |
|---|---|---|---|---|---|---|---|---|
| Nonanal * | 124-19-6 | | 1 | < 5 | | < 2 | | |
| Decanal * | 112-31-2 | | 1 | < 5 | | < 2 | | |
| **R-values** | | | | | | | 0.42 | 0.42 |
| **TVOC** | | | | 370 | 210 | 130 | | |

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## 5.2 VOC Emission Test Results after 28 Days

| | CAS No. | Retention time [min] | ID-Cat | Specific Conc. [µg/m³] | Toluene eq. [µg/m³] | Specific SER [µg/(m²·h)] | $R_D$ | $R_B$ |
|---|---|---|---|---|---|---|---|---|
| **VOC with NIK/LCI** | | | | | | | | |
| 1,2-Propandiol (Propylene glycol) * | 57-55-6 | 3.54 | 1 | 130 | 24 | 48 | 0.064 | 0.064 |
| n-Propylbenzene | 103-65-1 | 7.92 | 1 | 6.2 | 7.3 | 2.2 | 0.0065 | 0.0065 |
| **VOC without NIK/LCI** | | | | | | | | |
| None determined | | | | | | | | |
| **Sum of VOC without NIK/LCI** | | | | < 5 | < 5 | < 2 | | |
| **VVOC compounds** | | | | | | | | |
| None determined | | | | | | | | |
| **TVVOC** | | | | < 5 | < 5 | < 2 | | |
| **SVOC compounds** | | | | | | | | |
| None determined | | | | | | | | |
| **TSVOC** | | | | < 5 | < 5 | < 2 | | |
| **Carcinogens** | | | | | | | | |
| **Total carcinogens** | | | | < 1 | < 1 | < 1 | | |
| **CMR (French reg.)** | | | | | | | | |
| Benzene | 71-43-2 | | 1 | < 1 | | < 1 | | |
| Trichloroethylene | 79-01-6 | | 1 | < 1 | | < 1 | | |
| Dibutylphthalate (DBP)* | 84-74-2 | | 1 | < 1 | | < 1 | | |
| Diethylhexylphthalate (DEHP)* | 117-81-7 | | 1 | < 1 | | < 1 | | |
| **Aldehydes** | | | | | | | | |
| Formaldehyde | 50-00-0 | | 1 | < 3 | | < 2 | | |
| Acetaldehyde | 75-07-0 | | 1 | < 3 | | < 2 | | |
| Propionaldehyde | 123-38-6 | | 1 | < 3 | | < 2 | | |
| Butyraldehyde | 123-72-8 | | 1 | < 3 | | < 2 | | |
| Acrolein * | 107-02-8 | | 1 | < 5 | | < 2 | | |
| 2-Butenal * | 123-73-9 | | 1 | < 5 | | < 2 | | |
| Glutaraldehyde * | 111-30-8 | | 1 | < 5 | | < 2 | | |
| Octanal * | 124-13-0 | | 1 | < 5 | | < 2 | | |
| Nonanal * | 124-19-6 | | 1 | < 5 | | < 2 | | |
| Decanal * | 112-31-2 | | 1 | < 5 | | < 2 | | |

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| | CAS No. | Retention time [min] | ID-Cat | Specific Conc. [µg/m³] | Toluene eq. [µg/m³] | Specific SER [µg/(m²·h)] | $R_D$ | $R_B$ |
|---|---|---|---|---|---|---|---|---|
| **R-values** | | | | | | | 0.070 | 0.070 |
| **TVOC** | | | | 140 | 31 | 50 | | |
| TVOC (French label) | | | | | 43 | | | |
| Toluene | 108-88-3 | | | < 2 | < 2 | < 1 | | |
| Tetrachloroethylene | 127-18-4 | | | < 2 | < 2 | < 1 | | |
| Ethylbenzene | 100-41-4 | | | 3.3 | 3.5 | 1.2 | | |
| Xylene | 1330-20-7 | | | 2.4 | 2.6 | 0.84 | | |
| Styrene | 100-42-5 | | | < 2 | < 2 | < 1 | | |
| 2-Butoxyethanol | 111-76-2 | | | < 2 | < 2 | < 1 | | |
| 1,2,4-Trimethylbenzene | 95-63-6 | | | < 2 | < 2 | < 1 | | |
| 1,4-Dichlorobenzene | 106-46-7 | | | < 2 | < 2 | < 1 | | |

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# 6 Summary and Evaluation of the Results

## 6.1 Comparison with Limit Values of the French VOC Regulation

| | CAS No. | Conc. 28 days µg/m³ | C µg/m³ | B µg/m³ | A µg/m³ | A+ µg/m³ |
|---|---|---|---|---|---|---|
| TVOC | - | 43 | >2000 | <2000 | <1500 | <1000 |
| Formaldehyde | 50-00-0 | < 3 | >120 | <120 | <60 | <10 |
| Acetaldehyde | 75-07-0 | < 3 | >400 | <400 | <300 | <200 |
| Toluene | 108-88-3 | < 2 | >600 | <600 | <450 | <300 |
| Tetrachloroethylene | 127-18-4 | < 2 | >500 | <500 | <350 | <250 |
| Ethylbenzene | 100-41-4 | 3.3 | >1500 | <1500 | <1000 | <750 |
| Xylene | 1330-20-7 | 2.4 | >400 | <400 | <300 | <200 |
| Styrene | 100-42-5 | < 2 | >500 | <500 | <350 | <250 |
| 2-Butoxyethanol | 111-76-2 | < 2 | >2000 | <2000 | <1500 | <1000 |
| 1,2,4-Trimethylbenzene | 95-63-6 | < 2 | >2000 | <2000 | <1500 | <1000 |
| 1,4-Dichlorobenzene | 106-46-7 | < 2 | >120 | <120 | <90 | <60 |

The product was assigned a VOC emission class without taking into account the measurement uncertainty associated with the result. As specified in French Decree no. 2011-321 of March 23 2011, correct assignment of the VOC emission class is the sole responsibility of the party responsible for distribution of the product in the French market.

## 6.2 Comparison with Limit Values of the CMR Components

| CMR (French reg.) | CAS No. | Conc. 28 days µg/m³ | Max. allowed air concentration µg/m³ |
|---|---|---|---|
| Benzene | 71-43-2 | < 1 | < 1 |
| Trichloroethylene | 79-01-6 | < 1 | < 1 |
| Dibutylphthalate (DBP)* | 84-74-2 | < 1 | < 1 |
| Diethylhexylphthalate (DEHP)* | 117-81-7 | < 1 | < 1 |

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## 6.3 Comparison with Limit Values of the Italian CAM Regulation

| | CAS No. | Conc. 28 days µg/m³ | Limit value 28 days µg/m³ |
|---|---|---|---|
| TVOC | - | 43 | <1500 |
| Formaldehyde | 50-00-0 | < 3 | <60 |
| Acetaldehyde | 75-07-0 | < 3 | <300 |
| Toluene | 108-88-3 | < 2 | <450 |
| Tetrachloroethylene | 127-18-4 | < 2 | <350 |
| Ethylbenzene | 100-41-4 | 3.3 | <1000 |
| Xylene | 1330-20-7 | 2.4 | <300 |
| Styrene | 100-42-5 | < 2 | <350 |
| 2-Butoxyethanol | 111-76-2 | < 2 | <1500 |
| 1,2,4-Trimethylbenzene | 95-63-6 | < 2 | <1500 |
| 1,4-Dichlorobenzene | 106-46-7 | < 2 | <90 |
| Benzene | 71-43-2 | < 1 | <1 |
| Trichloroethylene | 79-01-6 | < 1 | <1 |
| Dibutylphthalate (DBP)* | 84-74-2 | < 1 | <1 |
| Diethylhexylphthalate (DEHP)* | 117-81-7 | < 1 | <1 |

The product was assigned a VOC emission class without taking into account the measurement uncertainty associated with the result.

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## 6.4 Comparison with Limit Values of AgBB/ABG

| Parameter | Test after 3 days | | Test after 28 days | |
|---|---|---|---|---|
| | Concentration mg/m³ | Limit Value mg/m³ | Concentration mg/m³ | Limit Value mg/m³ |
| **TVOC** | 0.37 | ≤ 10 | 0.14 | ≤ 1.0 |
| **TSVOC** | < 0.005 | - | < 0.005 | ≤ 0.1 |
| **R-value (dimensionless)** | 0.42 | - | 0.070 | ≤ 1 |
| **Sum of VOC without NIK/LCI** | 0.030 | - | < 0.005 | ≤ 0.1 |
| **Formaldehyde** | - | - | < 0.003 | ≤ 0.1 |
| **Total carcinogens** | < 0.001 | ≤ 0.01 | < 0.001 | ≤ 0.001 |

Compliance with the limits alone does not replace an approval or voluntary documentation by a Technical Assessment Body according to the Construction Product Regulation. This requires an application and approval. See www.eurofins.com/dibt-procedures.

## 6.5 Comparison with Limit Values of the Belgian Regulation

| Parameter | Test after 28 days | |
|---|---|---|
| | Concentration µg/m³ | Limit Value µg/m³ |
| **TVOC (EN 16516)** | 31 | ≤ 1000 |
| **TSVOC** | < 5 | ≤ 100 |
| **R-value (dimensionless)** | 0.070 | ≤ 1 |
| **Total carcinogens** | < 1 | ≤ 1 |
| **Toluene** | < 5 | ≤ 300 |
| **Formaldehyde** | < 3 | ≤ 100 |
| **Acetaldehyde** | < 3 | ≤ 200 |

## 6.6 Comparison with Limit Values of LEED v4.1

| Parameter | Test after 28 days | |
|---|---|---|
| | Concentration µg/m³ | Limit Value µg/m³ |
| **TVOC (EN 16516)** | 31 | - |
| **Formaldehyde** | < 3 | ≤ 10 |
| **Single VOC's with LCI value (AgBB 2018)** | Complies | ≤ LCI |

The tested product is purely shown to comply with the VOC emission requirements of LEED v4.1. In order to contribute towards satisfying fully the credit on "Low-Emitting Material" according to the requirements of LEED v4.1, the product also has to comply with the VOC content requirements.

## 6.7 Comparison with Limit Values of BREEAM International

| Parameter | Concentration mg/m³ | Basic Level mg/m³ | Exemplary Level mg/m³ |
|---|---|---|---|
| **Formaldehyde 28 days** | < 0.003 | ≤ 0.06 | ≤ 0.01 |
| **TVOC (EN 16516) 28 days** | 0.031 | ≤ 1.0 | ≤ 0.3 |
| **TSVOC 28 days** | < 0.005 | - | ≤ 0.1 |
| **total carcinogens 28 days** | < 0.001 | ≤ 0.001 | ≤ 0.001 |

## 6.8 Comparison with Limit Values of Indoor Air Comfort®

| | Test after 3 days | | Test after 28 days | |
|---|---|---|---|---|
| | **Concentration** µg/m³ | **Limit Value** µg/m³ | **Concentration** µg/m³ | **Limit Value** µg/m³ |
| **TVOC (EN 16516)** | 210 | ≤ 10000 | 31 | ≤ 1000 |
| **TSVOC** | < 5 | - | < 5 | ≤ 100 |
| **$R_D$-value (NIK) (dimensionless)** | 0.42 | - | 0.070 | ≤ 1 |
| **$R_B$-value (LCI) (dimensionless)** | 0.42 | - | 0.070 | ≤ 1 |
| **Sum of VOC without NIK/LCI** | 30 | - | < 5 | ≤ 100 |
| **Total carcinogens** | < 1 | ≤ 10 | - | - |
| **Any individual carcinogens** | - | - | < 1 | ≤ 1 |
| **CMR (French reg.)** | - | - | < 1 | ≤ 1 |
| **Formaldehyde** | 3.4 | - | < 3 | ≤ 60 |
| **Acetaldehyde** | 32 | - | < 3 | ≤ 200 |
| **French A+/A** | - | - | Complies | |

Compliance with the limits alone does not entitle to use the Indoor Air Comfort label. This requires an application, site inspection, and approval. See www.eurofins.com/iac-procedures.

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## 6.9 Comparison with Limit Values of Indoor Air Comfort Gold®

| | Test after 3 days | | Test after 28 days | |
|---|---|---|---|---|
| | **Concentration** µg/m³ | **Limit Value** µg/m³ | **Concentration** µg/m³ | **Limit Value** µg/m³ |
| **TVOC (EN 16516)** | 210 | ≤ 750 | 31 | ≤ 60 |
| **TSVOC** | < 5 | - | < 5 | ≤ 30 |
| **$R_D$-value (NIK) (dimensionless)** | 0.42 | - | 0.070 | ≤ 1 |
| **$R_B$-value (LCI) (dimensionless)** | 0.42 | - | 0.070 | ≤ 1 |
| **Sum of VOC without NIK/LCI** | 30 | - | < 5 | ≤ 40 |
| **Total carcinogens** | < 1 | ≤ 10 | - | - |
| **Any individual carcinogens** | - | - | < 1 | ≤ 1 |
| **CMR (French reg.)** | - | - | < 1 | < 1 |
| **Formaldehyde** | 3.4 | ≤ 50 | < 3 | < 10 |
| **Acetaldehyde** | 32 | ≤ 50 | < 3 | ≤ 50 |
| **Sum Formaldehyde + Acetaldehyde [ppb]** | < 5 | ≤ 50 | - | - |
| **Propionaldehyde** | - | - | < 3 | ≤ 60 |
| **Butyraldehyde** | - | - | < 3 | ≤ 60 |
| **French A+** | - | - | Complies | |

Compliance with the limits alone does not entitle to use the Indoor Air Comfort GOLD label. This requires an application, site inspection, and approval. See www.eurofins.com/iac-procedures.

## 6.10 Comparison with Limit Values of EMICODE

| Parameter | Concentration µg/m³ | EC 2 µg/m³ | EC 1 µg/m³ | EC 1 PLUS µg/m³ |
|---|---|---|---|---|
| **TVOC 3 days (EN 16516)** | 210 | ≤ 3000 | ≤ 1000 | ≤ 750 |
| **TVOC 28 days (EN 16516)** | 31 | ≤ 300 | ≤ 100 | ≤ 60 |
| **TSVOC 28 days (EN 16516)** | < 5 | ≤ 100 | ≤ 50 | ≤ 40 |
| **Sum without NIK/LCI 28 days** | < 5 | >40 | | ≤ 40 |
| **R-value 28 days (dimensionless)** | 0.070 | >1 | | ≤ 1 |
| **Formaldehyde 3 days** | 3.4 | ≤ 50 | | |
| **Acetaldehyde 3 days** | 32 | ≤ 50 | | |
| **Sum Formaldehyde + Acetaldehyde [ppm]** | 0.020 | ≤ 0.05 | | |
| **Sum carcinogens 3 days** | < 1 | ≤ 10 | | |
| **Sum carcinogens 28 days** | < 1 | ≤ 1 | | |

This test report does not alone entitle to use the protected trademark label EMICODE. For the use of an EMICODE label a license has to be applied for at the GEV, Düsseldorf, Germany. A license can only be granted for ready-to use products, if some additional requirements on contents of certain chemicals (e.g. solvent-free) are fulfilled.

## 6.11 Comparison with Limit Values of Blue Angel (DE-UZ 113)

| | Test after 3 days | | Test after 28 days | |
|---|---|---|---|---|
| | **Concentration** µg/m³ | **Limit Value** µg/m³ | **Concentration** µg/m³ | **Limit Value** µg/m³ |
| **TVOC with SVOCs with NIK/LCI, w/o acetic acid** | 370 | ≤ 1000 | 140 | ≤ 60 |
| **Acetic acid** | < 5 | ≤ 2000 | < 5 | ≤ 140 |
| **TSVOC w/o SVOCs with NIK/LCI** | < 5 | - | < 5 | ≤ 50 |
| **R-value (dimensionless)** | 0.42 | - | 0.070 | ≤ 1 |
| **Sum of VOC without NIK/LCI** | 30 | - | < 5 | ≤ 40 |
| **Total carcinogens** | < 1 | ≤ 10 | - | - |
| **Any individual carcinogens** | - | - | < 1 | ≤ 1 |
| **Formaldehyde [ppm]** | - | - | < 0.005 | ≤ 0.05 |
| **Other aldehydes [ppm]** | - | - | < 0.005 | ≤ 0.05 |

The results are only valid for the tested sample(s).
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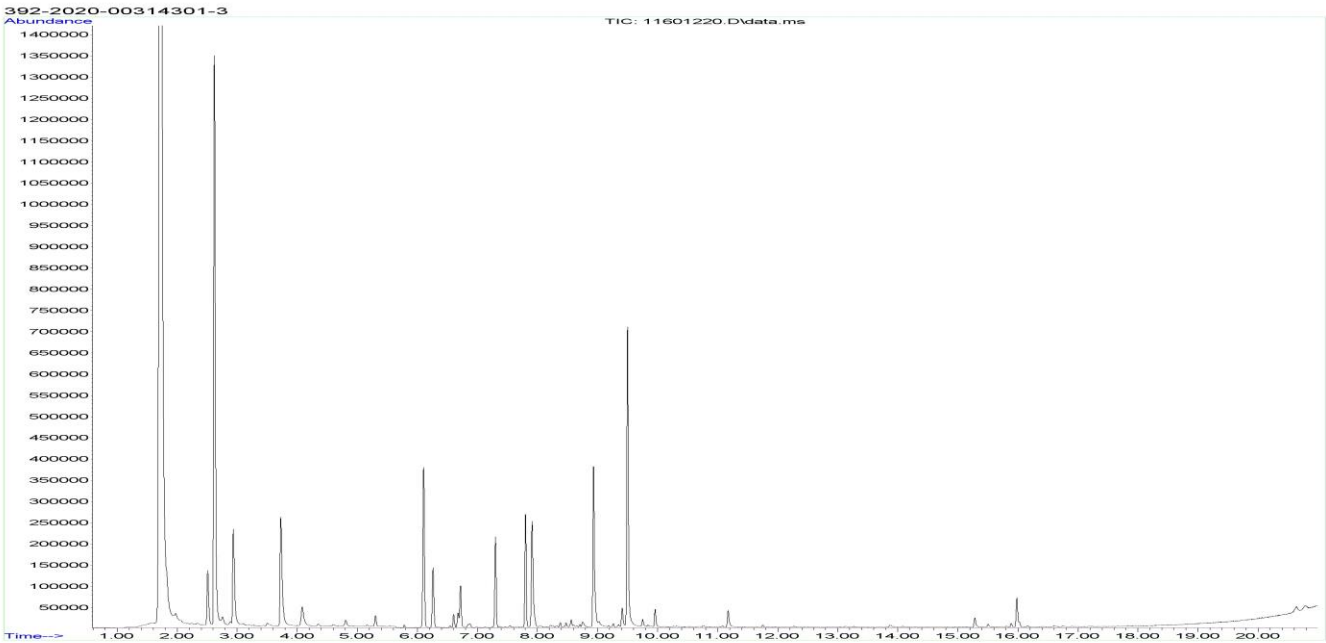
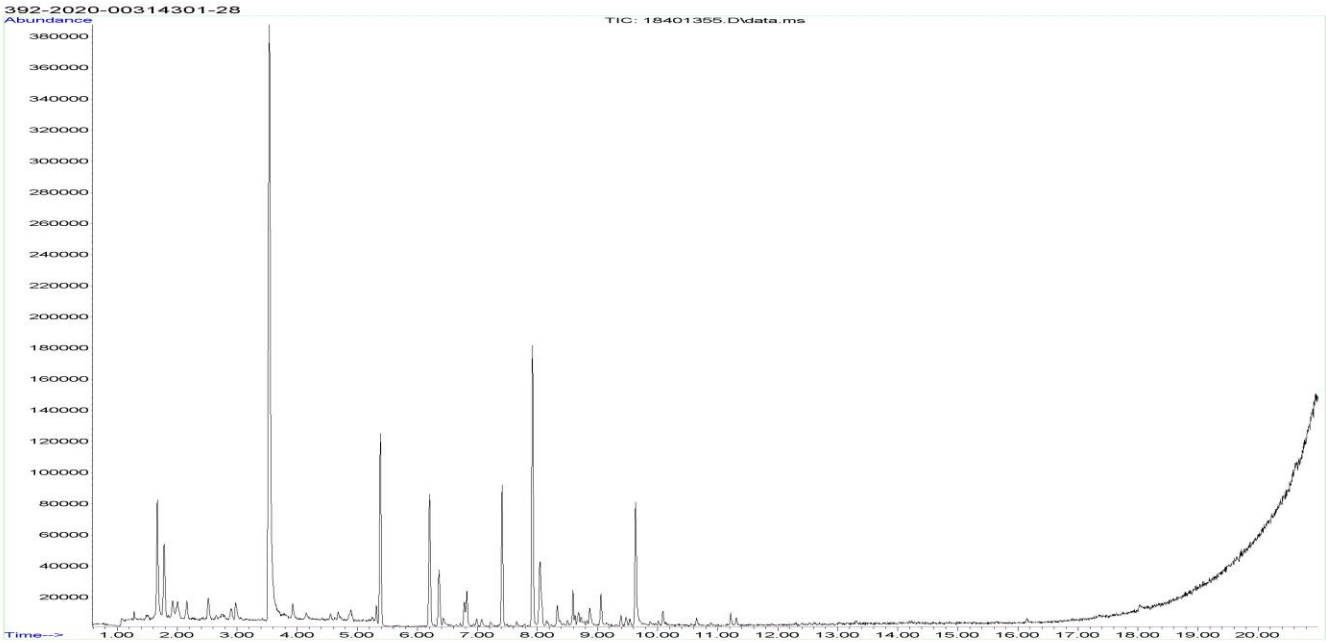
# 7 Appendices

## 7.1 Chromatogram of VOC Emissions after 3 Days




## 7.2 Chromatogram of VOC Emissions after 28 Days




Please consider the different scales.

## 7.3 How to Understand the Results

### 7.3.1 Acronyms Used in the Report

| | |
|---|---|
| < | Means less than |
| > | Means bigger than |
| * | Not a part of our accreditation |
| ¤ | Please see section regarding uncertainty in the Appendices |
| § | Deviation from method. Please see deviation section |
| a | The method is not optimal for very volatile compounds. For these substances smaller results and a higher measurement uncertainty cannot be ruled out |
| b | The component originates from the substrate and is thus removed |
| c | The results have been corrected by the emission from the substrate |
| d | Very polar organic compounds are not suitable for reliable quantification using Tenax TA adsorbent and HP-5 GC column. A high degree of uncertainty must be expected |
| e | The component may be overestimated due to contribution from the system |
| SER | Specific Emission Rate |

### 7.3.2 Explanation of ID Category

**Categories of Identity:**

1: Identified by comparison with a mass spectrum obtained from library and supported by other information and quantified through specific calibration.

2: Identified by comparison with a mass spectrum obtained from library and supported by other information. Quantified as toluene equivalent.

3: Identified with a lower match by comparison with a mass spectrum obtained from a library. Quantified as toluene equivalent.

4: Not identified, quantified as toluene equivalent.

## 7.4 Applied LCI and NIK Values

### 7.4.1 LCI/NIK Values for Compounds found after 3 Day Measurements

| Compound | CAS No. | AgBB 2018 NIK [µg/m³] | Belgian NIK [µg/m³] |
|---|---|---|---|
| 1-Butanol | 71-36-3 | 3000 | 3000 |
| 1-Methoxy-2-propanol * | 107-98-2 | 7900 | 7900 |
| Ethylbenzene | 100-41-4 | 850 | 850 |
| m/p-Xylene * | 179601-23-1 | 500 | 500 |
| Other alkylbenzenes * | | 450 | 450 |
| n-Propylbenzene | 103-65-1 | 950 | 950 |
| Benzaldehyde | 100-52-7 | 90 | 90 |
| 2-Ethyl-1-hexanol | 104-76-7 | 300 | 300 |
| Acetophenone | 98-86-2 | 490 | 490 |
| Formaldehyde | 50-00-0 | 100 | 100 |
| Acetaldehyde | 75-07-0 | 1200 | 1200 |

### 7.4.2 LCI/NIK Values for Compounds found after 28 Day Measurements

| Compound | CAS No. | AgBB 2018 NIK [µg/m³] | Belgian NIK [µg/m³] |
|---|---|---|---|
| 1,2-Propandiol (Propylene glycol) * | 57-55-6 | 2100 | 2100 |
| n-Propylbenzene | 103-65-1 | 950 | 950 |

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## 7.5 Description of VOC Emission Test

### 7.5.1 Test Chamber

The test chamber is made of stainless steel. A multi-step air clean-up is performed before loading the chamber, and a blank check of the empty chamber is performed.
The chamber operation parameters are as described in the test method section. (EN 16516, ISO 16000-9, internal method no.: 71M549811).

### 7.5.2 Expression of the Test Results

All test results are calculated as specific emission rate, and as extrapolated air concentration in the European Reference Room (EN 16516, AgBB, EMICODE, M1 and Indoor Air Comfort).

### 7.5.3 Testing of Carcinogenic VOCs

The emission of carcinogens (EU Categories C1A and C1B, as per European law) is tested by drawing sample air from the test chamber outlet through Tenax TA tubes after the specified duration of storage in the ventilated test chamber. Analysis is performed by ATD-GC/MS (automated thermal desorption coupled with gas chromatography and mass spectroscopy using 30 m HP-5 (slightly polar) column with 0.25 mm ID and 0.25 µm film, Agilent) (EN 16516, ISO 16000-6, internal methods no.: 71M549812 / 71M542808B).

All identified carcinogenic VOCs are listed; if a carcinogenic VOC is not listed then it has not been detected. Quantification is performed using the TIC signal and authentic response factors, or the relative response factors relative to toluene for the individual compounds.

This test only covers substances that can be adsorbed on Tenax TA and can be thermally desorbed. If other emissions occur, then these substances cannot be detected (or with limited reliability only).

### 7.5.4 Testing of VOC, SVOC and VVOC

The emissions of volatile organic compounds are tested by drawing sample air from the test chamber outlet through Tenax TA tubes after the specified duration of storage in the ventilated test chamber. Analysis is performed by ATD-GC/MS using HP-5 column (30 m, 0.25mm ID, 0.25µm film) (EN 16516, ISO 16000-6, internal methods no.: 71M549812 / 71M542808B).

All single substances that are listed with a LCI/NIK value in the latest publications (hereafter referred to as target compounds) are identified if present. All other appearing VOCs are identified as far as possible. Quantification of target compounds is done using the TIC signal and authentic response factors, or the relative response factors relative to toluene. For certain compound groups, which differ significantly in chemistry from toluene, quantification is performed relative to a representative member of the group for more accurate and precise results. This can include quantification of for example glycols and acids. In addition to that, all results are also expressed in toluene equivalents. All non-target compounds, as well as all non-identified substances, are quantified in toluene equivalents.

The results of the individual substances are calculated in three groups depending on their retention time when analyzing using a non-polar column (HP-1):

- Volatile Organic Compounds (VOC) are defined as: All substances eluting between and including n-hexane (n-C6) and n-hexadecane (n-C16)
- Semi-Volatile Organic Compounds (SVOC) are defined as: All substances eluting after n-hexadecane (n-C16) and before and including n-docosane (n-C22)
- Very Volatile Organic Compounds (VVOC) are defined as: All substances eluting before n-hexane (n-C6).

Total Volatile Organic Compounds (TVOC) is calculated by summation of all individual VOCs with a concentration ≥ 5 µg/m³. The TVOC can be expressed either in toluene equivalents as defined in EN 16516 and similar to ISO 16000-6, or as the sum of concentrations using specific or relative response factors. In the case of summation of concentrations using authentic or relative response factors, the toluene equivalent is applied to all non-target and non-identified VOCs before summing up. Compounds regarded as VOC in line with the above definition but elute before n-C6 or after n-C16 on the HP-5 column are treated as VOC, and are thus added to the TVOC.

Total Semi-Volatile Organic Compounds (TSVOC) is calculated by the summation of all individual SVOCs expressed in toluene equivalents with a concentration ≥ 5 µg/m³, as defined in EN 16516. VOCs that are regarded as VOC in line with the above definition, but elute after n-C16 in this test, are not added to the TSVOC.

Total Very Volatile Organic Compounds (TVVOC) is calculated by the summation of all individual VVOCs with a concentration ≥ 5 µg/m³ and expressed in toluene equivalents. VOCs that are regarded as VOC in line with the above definition, but elute before n-C6 in this test, are not added to the TVVOC.

This test only covers substances which can be adsorbed on Tenax TA and can be thermally desorbed. If emissions of substances outside these specifications occur then these substances cannot be detected (or with limited reliability only).

### 7.5.5 Calculation of R Values with LCI Lists

The concentrations of detected compounds ≥ 5 µg/m³ are divided by their respective LCI/NIK value (if defined in the given publication). The sum of the quotients gives the R value, which can be mathematically expressed:

$$R = \sum_{i}^{n} \left( {}^{c_i}\!/_{NIK_i} + \ldots + {}^{c_n}\!/_{NIK_n} \right)$$

This R value is calculated, depending on the purpose of this test, for the European LCI list, for the German LCI/NIK list ($R_D$), and/or for the Belgian LCI list ($R_B$).

All VOCs without published LCI/NIK value and concentration ≥ 5 µg/m³ are summed up as sum of VOCs without LCI/NIK if required by the standard or protocol.

### 7.5.6 Testing of Aldehydes

The presence of aldehydes is tested by drawing air samples from the test chamber outlet through DNPH-coated silicagel tubes after the specified duration of storage in the ventilated test chamber. Analysis is performed by solvent desorption and subsequently by HPLC and UV-/diode array detection.

The absence of formaldehyde and other aldehydes is stated if UV detector response at the specific wavelength is lacking at the specific retention time in the chromatogram. Otherwise it is checked whether the reporting limit is exceeded. In this case the identity is finally checked by comparing full scan sample UV spectra with full scan standard UV spectra.

### 7.5.7 Testing of Phthalates

The presence of phthalates is tested by drawing air samples from the test chamber outlet through tube with XAD-II adsorbent after the specified duration of storage in the ventilated test chamber. Analysis is performed by solvent desorption and subsequently by GC/MS. Analysis of phthalates is not currently covered by the accreditation (Internal methods no.: 71M549812 / 71M546060).

The results are only valid for the tested sample(s).
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## 7.6 Quality Assurance

Before loading the test chamber, a blank check of the empty chamber is performed and compliance with background concentrations in accordance with EN 16516 / ISO 16000-9 is determined.

Air sampling at the chamber outlet and subsequent analysis is performed in duplicate. Relative humidity, temperature and air change rate in the chambers is logged every 5 minutes and checked daily. A double determination is performed on random samples at a regular interval and results are registered in a control chart to ensure the uncertainty and reproducibility of the method.

The stability of the analytical system is checked by a general function test of device and column, and by use of control charts for monitoring the response of individual substances prior to each analytical sequence.

## 7.7 Accreditation

The testing methods described above are accredited on line with EN ISO/IEC 17025 by DANAK (no. 522). This accreditation is valid worldwide due to mutual approvals of the national accreditation bodies (ILAC/IAF, see also www.eurofins.com/galten.aspx#accreditation).

Not all parameters are covered by this accreditation. The accreditation does not cover parameters marked with an asterisk (*), however analysis of these parameters is conducted at the same level of quality as for the accredited parameters.

## 7.8 Uncertainty of the Test Method

The relative standard deviation of the overall analysis is 22%. The expanded uncertainty Um equals 2 x RSD. For further information please visit www.eurofins.dk/uncertainty.

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