REPORT

Contract no.	20783/2026/1 – KW (Translation of the original report of 16.04.2026)	18.05.2026 HAE/MEJ
Customer	HASSLACHER Holding GmbH Feistritz 1 9751 Sachsenburg	
Subject	Measurement of the emissions of a sample according to EN 16516	
Date of contract	26.01.2026	
Date of sample delivery	05.02.2026	
Date/Period of service	Februar - April 2026	
Period of validity	--	
Pages	13	
Enclosures	--	

1. Contract

On January 26th, 2026 Holzforschung Austria was commissioned with the testing of the VOC, formaldehyde and carbonyl compound emissions of two samples of glued laminated timber.

Contact person: Mr. DI Wolfgang Bischof

2. Applied standards and guidelines

DIN ISO 16000-6 (2021): Indoor air — Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA sorbent, thermal desorption and gas chromatography using MS or MS-FID

ÖNORM EN ISO 16000-9 (2024): Indoor air — Part 9: Determination of the emission of volatile organic compounds from building products and furnishing — Emission test chamber method

ÖNORM EN ISO 16000-11 (2024): Indoor air — Part 11: Determination of the emission of volatile organic compounds from building products and furnishing — Sampling, storage of samples and preparation of test specimens

ISO 16000-3 (2022): Indoor air — Part 3: Determination of formaldehyde and other carbonyl compounds in indoor and test chamber air — Active sampling method

ÖNORM EN 16516 (2021): Construction products - Assessment of release of dangerous substances - Determination of emissions into indoor air

Committee for Health-related Evaluation of Building Products (Ausschuss zur gesundheitlichen Bewertung von Bauprodukten - AgBB) – AgBB 2024; Requirements for the Indoor Air Quality in Buildings: Health-related Evaluation Procedure for Emissions of Volatile Organic Compounds (VVOC, VOC and SVOC) from Building Products (incl. list of LCI values of 2022)

3. Sample specification

The first sample was delivered to Holzforschung Austria on February 5th, 2026. The specimen was packed airtight.

The sample consisted of 1 piece of glued laminated timber made of spruce, with the dimensions of 360 x 160 x 400 mm. The specimen was taken out of the ongoing production at the production site of NORITEC Holzindustrie GmbH (part of the HASSLACHER group) and was cut from inside of the material (all cutting edges new) before it was immediately packed airtight.

Table 1 shows the properties of the received sample.

Table 1: Samples

HFA sample label	Product	Batch no.	Type/series	Production date
20783/26_1	glued laminated timber spruce	208663	ESE20172323	03.02.2026

4. Test methods

The sample was tested in one of the 0.225 m³ emission chambers of Holzforschung Austria.

The sample was cut so that a loading factor of 0.4 m² emitting surface /m³ emission chamber volume was reached as specified in EN 16516 for materials used as ceiling components.

The edges of the sample were sealed with self-adhesive aluminium tape in accordance with EN 16516, before placing it in the emission chamber (figure 1).

Figure 1: Sample 20783/26_1 in the 0.225 m³ emission chamber

4.1. Emission chamber testing parameters

Table 2: Emission chamber testing parameters

Parameter	Value	Unit	Tolerance
Temperature	23	°C	± 1
Relative humidity	50	%	± 5
Air exchange rate	0.5	h^{-1}	± 0.015
Loading factor	0.4	m^2/m^3	
Area specific air flow rate q	1.25	m^3/hm^2	
Chamber volume	0.225	m^3	

Temperature and relative humidity conditions were met and recorded continuously during the entire test period.

4.2. Analysis of volatile organic compounds (VOC)

4.2.1. Sampling and analysis

For the sampling of VOC, a defined volume of emission chamber air is drawn through an adsorption tube filled with Tenax TA®, a porous polymer resin based on 2,6-diphenylene oxide. This material is suitable for the adsorption of volatile organic compounds of a chain length between C_6 (n-hexane) and C_{26} (hexacosane). According to the definitions of the WHO[1] this includes both VOC (volatile organic substances with boiling points between 50 °C and 250 °C) and SVOC (semi-volatile organic substances with boiling points between 250 °C and 390 °C).

Subsequent analysis of the Tenax TA®-Tubes is conducted according to ISO 16000-6 and EN 16516 by use of a thermal desorption unit coupled to a gas chromatograph with mass spectrometric detection.

4.2.2. Calibration

Calibration standards, grouped by substance class, were prepared in methanol, injected on Tenax TA® tubes under inert gas conditions and analysed via the above described method. The calibration spans a range of approx. 1 - 250 µg/m for each substance.

4.2.3. Qualitative analysis

Identification of the detected substances is carried out by comparing the obtained chromatograms with mass spectra of commercial spectra libraries and the retention times and fragment ion spectra of commercially available standards.

4.2.4. Quantitative analysis

Substance specific quantification of individual compounds is carried out by integrating the peak areas of target and qualifier ions using the above described calibration. Cyclodecane is used as an internal standard.

Substances not included in the calibration are quantified either via related substances or as toluene equivalents.

[1] World Health Organization, WHO (1989) – Indoor Air Quality: Organic Pollutants. Euro reports and studies, 11. Copenhagen, Regional Office for Europe.

4.3. Analysis of formaldehyde (and other carbonyl compounds)

4.3.1. Sampling on 2,4-Dinitrophenylhydrazine (DNPH) and analysis

A defined volume of emission chamber air is drawn through a cartridge containing DNPH. The principle of this procedure is based on the reaction of carbonyl groups with DNPH in acidic media, resulting in the formation of stable hydrazine-derivatives.

Subsequent analysis of the eluted compounds was conducted according to ISO 16000-3 by use of a high pressure liquid chromatography system with a diode array detector (absorption wavelength 360 nm).

4.3.2. Calibration

Commercially available standards were used to prepare a dilution series, which was analysed via the above described method. The calibration spans a range of approx. 1 - 610 µg/m³ for each substance.

4.3.3. Qualitative analysis

Identification of the detected compounds is carried out by comparison of their retention times with those of commercially available standards and information regarding the retention times of the substances on the used Acclaim Carbonyl C18 column.

4.3.4. Quantitative analysis

Substance specific quantification of individual compounds takes place by integrating the peak areas of the substances. To check the detector sensitivity a reference standard mix is analysed before the start of each series of measurements.

5. Results

Categorization of VVOC, VOC and SVOC was performed according to EN 16516 and based on the AgBB guidelines with the following scheme:

- VVOC substances within a retention range of < C_6
- VOC substances within a retention range of C_6-C_{16}
- $TVOC_{spec}$ sum of VOC substances with concentrations ≥5 µg/m³ quantitation by substance specific calibration according to EN 16516 and. AgBB
- TVOC sum of VOC substances with concentrations ≥5 µg/m³ quantitation via toluene equivalents according to EN 16516
- SVOC substances within a retention range of C_{16}-C_{22}
- TSVOC sum of SVOC substances with concentrations ≥5 µg/m³

In compliance with the AgBB guidelines, acetic acid, though eluting before C_6, is also included in the TVOC.
Carcinogenic substances (CARC 1A and CARC 1B, according to regulation (EC) No 1272/2008) are reported and included in the results starting from a concentration of 1 µg/m³.

All results are mean values resulting from repeat determinations (n=2).

The directly measured concentration results in the chamber air (µg/m³) shown in 5.1, were obtained with a loading factor of 0.4 m²/m³ as described in section 4 “Test methods”. With an air exchange rate of 0.5 h^{-1} this resulted in an area specific air flow rate q of 1.25 m³/hm².

In accordance with EN 16516 guidelines a result conversion to the area specific emission rate SER (unit: µg/m²h), which corresponds to the results at an area specific air flow rate q of 1.0 m³/hm² (unit: µg/m³ see 5.3) was done.

These results and the list of the "lowest concentrations of interest" (LCI values) of the current AgBB guidelines were used for the calculation of the substance specific R_i:

$$R_i = \frac{c_i}{LCI_i}$$

with

R_i:	substance specific R value
c_i:	determined concentration in µg/m³
LCI_i:	specific LCI value of the substance

For the assessment of the total emissions of the sample on day 28, all substance specific R_i-values are summed up to the actual R value.

$$R = \sum R_i$$

For these calculations the updated LCI values of the AgBB guidelines 2024 were used.

The R value was calculated with the directly measured concentration results in accordance with the AgBB guidelines at a q of 1.25 m³/hm² and also with the results calculated for a q of 1.0 m³/hm² to enable the comparison with other specifications (e.g. various eco labels).

5.1. Results of measurements of VOC, SVOC and Formaldehyde at an area specific air flow rate q of 1.25 m³/hm² (directly measured chamber air concentrations)

Table 3: concentration results VOC, SVOC and Formaldehyde

Substance	CAS - No.	Mean value sampling day 3		Mean value sampling day 28		Expanded uncertainty of the method (k=2)
TD/GC/MS analysis in accordance with EN 16516 / ISO 16000-6		**Substance spec. [µg/m³]**	**Toluol equiv. [µg/m³]**	**Substance spec. [µg/m³]**	**Toluol equiv. [µg/m³]**	
Acetic acid	64-19-7	26	*< 5*	62	*< 5*	± 40 %
Pentanal	110-62-3	13	6	7	*< 5*	
Hexanal	66-25-1	34	21	22	12	
Alpha-Pinene	80-56-8	67	104	52	61	
gamma-Valerolactone[a]	108-29-2	*< 5*	*< 5*	27	24	
Beta-Pinene	127-91-3	35	40	27	26	
Delta-3-Carene	13466-78-9	31	35	26	26	
Limonene	138-86-3	47	50	42	39	
beta-Phellandrene[a]	555-10-2	11	11	6	6	
HPLC/DAD analysis in accordance with EN 16516 / ISO 16000-3		**Substance spec. [µg/m³]**		**Substance spec. [µg/m³]**		± 25 %
Formaldehyde*	50-00-0	15		7		
Acetaldehyde*	75-07-0	21		11		
Acetone*	67-64-1	13		9		
TVOCspec		**264**	**---**	**271**	**---**	
TVOC		**---**	**267**	**---**	**194**	
TSVOC		**---**	**---**	**---**	**---**	

* VVOC
a quantified via toluene equivalents

5.2. Calculation of R value with directly measured chamber air concentrations

Table 4: calculation of the R value for a q of 1.25 m³/hm²

Substance	CAS - No	Mean value Sampling day 28 Substance spec. [µg/m³]	LCI values [µg/m³]	R_i values
Acetic acid	64-19-7	62	1200	0.05
Pentanal	110-62-3	7	800	0.009
Hexanal	66-25-1	22	900	0.02
Alpha-Pinene	80-56-8	52	2500	0.02
Beta-Pinene	127-91-3	27	1400	0.02
Delta-3-Carene	13466-78-9	26	1500	0.02
Limonene	138-86-3	42	5000	0.008
beta-Phellandrene	555-10-2	6	1400	0.004
Formaldehyde*	50-00-0	7	100	0.07
Acetaldehyde*	75-07-0	11	300	0.04
Acetone*	67-64-1	9	120000	0.0001
Sum Ri values/R value				**0.26**

* VVOC

5.3. Calculated results of measurements of VOC, SVOC and Formaldehyde for a q of 1.00 m³/hm² (corresponds to the area specific emission rate SER)

Table 5: concentration results VOC, SVOC and Formaldehyde

Substance	CAS - No.	Mean value sampling day 3		Mean value sampling day 28		Expanded uncertainty of the method (k=2)
TD/GC/MS analysis in accordance with EN 16516 / ISO 16000-6		**Substance spec. [µg/m³]**	**Toluol equiv. [µg/m³]**	**Substance spec. [µg/m³]**	**Toluol equiv. [µg/m³]**	
Acetic acid	64-19-7	33	< 5	78	< 5	± 40 %
Pentanal	110-62-3	16	8	9	< 5	
Hexanal	66-25-1	43	26	28	15	
Alpha-Pinene	80-56-8	84	130	65	76	
gamma-Valerolactone[a]	108-29-2	< 5	< 5	34	30	
Beta-Pinene	127-91-3	44	50	34	33	
Delta-3-Carene	13466-78-9	39	44	33	33	
Limonene	138-86-3	59	63	53	49	
beta-Phellandrene[a]	555-10-2	14	14	8	8	
HPLC/DAD analysis in accordance with EN 16516 / ISO 16000-3		**Substance spec. [µg/m³]**		**Substance spec. [µg/m³]**		± 25 %
Formaldehyde*	50-00-0	19		9		
Acetaldehyde*	75-07-0	26		14		
Acetone*	67-64-1	16		11		
TVOCspec		**332**	**---**	**339**	**---**	
TVOC		**---**	**335**	**---**	**244**	
TSVOC		**---**	**---**	**---**	**---**	

* VVOC
a quantified via toluene equivalents

5.4. Calculation of R value for a q of 1.00 m³/hm² (corresponds to the area specific emission rate SER)

Table 6: calculation of the R value for a q of 1.00 m³/hm²

Substance	CAS - No	Mean value Sampling day 28 Substance spec. [µg/m³]	LCI values [µg/m³]	R_i values
Acetic acid	64-19-7	78	1200	0.07
Pentanal	110-62-3	9	800	0.01
Hexanal	66-25-1	28	900	0.03
Alpha-Pinene	80-56-8	65	2500	0.03
Beta-Pinene	127-91-3	34	1400	0.02
Delta-3-Carene	13466-78-9	33	1500	0.02
Limonene	138-86-3	53	5000	0.01
beta-Phellandrene	555-10-2	8	1400	0.006
Formaldehyde*	50-00-0	9	100	0.09
Acetaldehyde*	75-07-0	14	300	0.05
Acetone*	67-64-1	11	120000	0.0001
Sum Ri values/R value				**0.34**

* VVOC

6. Storage of samples

Samples will be kept in storage for a period of 3 months after completion of the measurements.

HOLZFORSCHUNG AUSTRIA

Mag. Elisabeth Habla
Authorisation to sign

Mag. Tamo Bachmayer
Technical execution

This report was approved electronically in accordance with an internal HFA process by the designated authorized signatory, traceable and documented.

Accreditation is given for the following procedures.
It is not allowed to use included accreditation marks for own purposes.

Accreditation Mark	*Type of accreditation*	*Procedure/s*
Akkreditierung Austria 0055 ISO/IEC 17025 T	*Testing*	• DIN ISO 16000-6 • ÖNORM EN ISO 16000-9 • ÖNORM EN ISO 16000-11 • DIN ISO 16000-3 • ÖNORM EN 16516

The results and statements given in this document relate only to the tested materials as received, the present information and the state of the art at the time of investigation.

Publication in excerpts is only permitted with the written approval of Holzforschung Austria.

The conformity assessment of the results is subject to the shared-risk approach.