REPORT

issued by an Accredited Testing Laboratory

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Emission measurements after 28 days

(3 appendices)

Object

One sample of a wooden panel was delivered to RISE by the customer.

Product name:	**Edge glued panel**
Manufacturing date:	2020-12-07
Size of sample:	one piece, 90 x 30 x 1.8 cm packed in aluminium and plastic foil
Date of arrival to RISE:	2020-12-09
Date of analysis:	week 51, 2020 – 06, 2021

Assignment

Emission measurement according to ISO 16000-9:2006 (Indoor air – Part 9: Determination of the emission of volatile organic compounds from building products and furnishing – Emission test chamber method), after 28 days regarding volatile organic compounds (VOC and VVOC/SVOC), carcinogenic substances (VOC-substances, EU Regulation No 1272/2008 Annex VI, cat 1A and 1B), formaldehyde and acetaldehyde (ISO 16000-3:2011). Evaluation according to EN 16516:2017/A1:2020 (EU-LCI values).

Method

The test was started 2020-12-18. The specimen was placed in a separate conditioning container (with air velocity of ca 0.2 m/s) in a room with controlled climate conditions of 23 ± 2 °C and 50 ± 5 % RH. The test specimen was placed into the chamber three days prior to air samplings. Air samplings after 28 days of conditioning were carried out on 2021-01-15.

Test conditions in the chamber:

Chamber volume:	1.0 m^3
Temperature:	23 ± 0.5 °C
Relative humidity:	50 ± 5 % RH
Surface area of test specimen:	0.31 m^2
Air exchange rate:	0.5 h^{-1}
Area specific air flow rate:	1.6 m^3/m^2 h.
Air velocity at specimen surface:	0.1 – 0.3 m/s

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Tenax TA was used as adsorption medium for VOC. The tubes were thermally desorbed and analysed in accordance to RISE method 0601, similar to ISO 16000-6:2011 (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/FID). This means an analysis in a gas chromatograph and detection with a flame ionisation detector (FID) and mass selective detector (MS). The capillary column used is coated with 5% phenyl/ 95 % methylpolysiloxane. The FID signals are used for compound quantification. The total volatile organic compounds (TVOC) means compounds eluting between and including n-hexane to hexadecane, having boiling points in the range of about 70-260 °C. Minimum duplicate air samples were taken and the results are mean values. Sampled volumes are 2 to 6 L.

Tenax TA was also used as adsorption medium for testing of volatile carcinogenic compounds according to EU Regulation No 1272/2008 Annex VI, cat 1A and 1B), (exclusive formaldehyde), 1 µg/m^3 and above.

The samplings of aldehydes were carried out with DNPH samplers. The samplers were analysed according to RISE method 2302, similar to ISO 16000-3:2011(Indoor air - Part 3: Determination of formaldehyde and other carbonyl compounds – Active sampling method). This means analysis on a liquid chromatograph with absorbance detector. Duplicate air samples were taken and the results are mean values. Sampled volumes were 60 L.

Results

The results relate only to the items tested. The results in Table 1 are expressed as area specific emission rates and as concentrations in a reference room (according to to EN 16516:2017/A1). The reference room has a base area of 3 m x 4 m and a height of 2.5 m, with an air exchange rate of 0.5 h^{-1}. The wall area is 31.4 m^2, floor area is 12 m^2, small area, like a door, is 1.6 m^2 and very small area, like sealant, is 0.2 m^2. **Small area** is used for the calculation of the concentrations.

Calculation of the concentration from the emission rate:

$$C = \frac{E_a \times A}{n \times V}$$

C = concentration of VOC in the reference room, in µg/m^3
E_a = area specific emission rate, in µg/m^{2}h
A = surface area of product in reference room, in m^2
n = air exchange rate, in changes per hour, here 0.5 h^{-1}
V = volume of the reference room, in m^3, here 30 m^3

Table 1.
Emission results of **Edge glued panel** after 28 days

Volatile organic compounds	CAS number	Retention time (min)	ID[1]	Emission rate ($\mu g/m^2h$)	Concentration in reference room ($\mu g/m^3$)	LCI_i ($\mu g/m^3$)	R_i (c_i/LCI_i)
TVOC ($C_6 - C_{16}$)	--	6.2 – 38	B	940	100	--	--
Volatile Carcinogens [2]		6.2– 38					
No substances detected	--	--	B	< 1	< 1	--	--
VOC with LCI [3]		6.2 – 38					
Pentanal	110-62-3	8.5	A	37	< 5	800	--
1-Pentanol	71-41-0	10.4	A	36	< 5	730	--
Hexanal	66-25-1	11.8	A	83	9	900	0.099
α-Pinene	80-56-8	17.3	A	490	53	2500	0.021
Hexanoic acid	142-62-1	17.6	A	29	< 5	2100	--
β-Pinene	127-91-3	18.9	A	16	< 5	1400	--
3-Carene	13466-78-9	20.1	A	430	46	1500	0.030
Limonene	138-86-3	20.8	A	14	< 5	5000	--
Terpinolene	586-62-9	22.9	A	23	< 5	1400	--
∑ VOC with LCI	--	--	A	1200	110	--	--
VOC without LCI [4]		6.2 – 38					
No substances detected	--	--	B	< 2	< 5	--	--
∑ VOC without LCI	--	--	B	< 2	< 5	--	--
SVOC ($C_{16} - C_{22}$) [5]		38 - 51					
No substances detected	--	--	B	< 2	< 5	--	--
∑ SVOC	--	--	B	< 2	< 5	--	--
VVOC (< C_6) [6]		5.4 – 6.2					
Acetic acid	64-19-7	5.5	A	36	< 5	1200	--
Formaldehyde [7]	50-00-0	--	A	38	< 5	100	--
Acetaldehyde [7]	75-07-0	--	A	10	< 5	1 200	--
∑ VVOC	--	--	A	84	< 5	--	--
R = ∑ C_i / LCI_i [8]	--	--	--	--	--	--	0.15

[1)] ID: A = quantified compound specific, B = quantified as toluene-equivalent
[2)] Volatile carcinogens = VOCs according to EU Regulation No 1272/2008 Annex VI, cat 1A and 1B
[3)] VOC with LCI = identified VOC-compound with LCI-value according to EU-LCI, Dec 2019
[4)] VOC without LCI = VOC-compound without LCI-value or not identified.
[5)] SVOC = semi-volatile organic compounds, as defined in ISO 16000-6 (not part of accreditation)
[6)] VVOC = very volatile organic compounds, as defined in ISO 16000-6 (not part of accreditation)
[7)] VVOC-aldehydes measured with DNPH samplers (ISO 16000-3)
[8)] All VVOC, VOC, SVOC and carcinogens with LCI

Only VOC-compounds with an emission rate higher than 2 µg/m²h are listed in Table 1, carcinogenic compounds ≥ 1 µg/m²h. Only the compounds with a concentration in the reference room > 5 µg/m³ are evaluated based on LCI (= lowest concentration of interest). TVOC is the sum of all individual substances with concentrations ≥ 5 µg/m³ (in toluene equivalents).

Quantification limit for TVOC is 10 µg/m²h. Measurement uncertainty for VOC is 15 % (rel) and for formaldehyde 30 % (rel). Background of TVOC in the empty chamber was below 10 µg/m³ and is subtracted.

See Appendix 1 for a gas chromatogram (FID spectra) and Appendix 2 for a photo of the test specimen. Appendix 3 is the sampling report received from the customer.

Summary of the test results

The test results are summarized in Table 2.

Table 2.
Summary of the emission results after 28 days of **Edge glued panel**

Compounds	**Emission rate** (µg/m²h)	**Concentration in reference room** (µg/m³)
TVOC	940	100
∑ Carcinogenic VOCs	< 1	< 1
∑ VOC with LCI	1200	110
∑ VOC without LCI	< 2	< 5
∑ VVOC	84	< 5
Formaldehyde	38	< 5
∑ SVOC	< 2	< 5
$R = \sum C_i / LCI_i$	0.2	

Evaluation of the test results

The emission results can be compared to different Emission Labelling Systems.

Byggvarubedömningen has criteria regarding Emissions to indoor environment. The emissions are to be measured according to a standard method such as ISO 16000-9 after 28 days regarding VOC and aldehydes. The requirements for the **Recommended class** are that the test results of TVOC, VOC and aldehydes are in compliance with the requirements of these parameters in one of the following systems: Emicode EC1, Emicode EC1^{PLUS}, Blue Angel, M1 (RTS) or GUT.

The results of the tested sample are compared to **Blue Angel, DE-UZ 176** Low-Emission Floor Coverings, Panels and Doors for Interiors made of Wood and Wood-Based Materials (Edition Jan 2013, ver 5, valid until 2022).

Decision rule: When comparing the measured results and requirement level, the average value of the measured results has been compared with the requirement level. No account is taken to the measurement uncertainty.

Table 3.
The test results of **Edge glued panel** compared to the relevant requirements in DE-UZ 176

Compounds	**Requirements DE-UZ 176** [9] (mg/m^3)	**Test Results** (mg/m^3)	**Pass / Fail**
TVOC [10]	≤ 0.3	**0.110**	**PASS**
TSVOC	≤ 0.1	**< 0.005**	**PASS**
Total VOC without LCI	≤ 0.1	**< 0.005**	**PASS**
CMR 1A+1B	≤ 0.001	**< 0.001**	**PASS**
R value	≤ 1	**0.2**	**PASS**
Formaldehyde	≤ 0.05 ppm = ≤ 0.06	**< 0.005**	**PASS**
Ammonia (if treated)	≤ 0.1	not measured	--

[9)] In Blue Angel, DE-UZ 176 there are also requirements after 3 days, not measured here.

[10)] DE-UZ 176: LCI-values according to AgBB, latest version: Aug 2018.
TVOC is here $TVOC_{spez}$: $TVOC_{spez}$ = ∑ VOC with LCI + ∑ VOC without LCI + ∑ SVOC.
Note: VVOC with LCI values are not included in $TVOC_{spez}$.

Results of evaluation:

The test results of TVOC, VOC and aldehydes are in compliance with the requirements of Blue Angel, DEL-UZ 176 after 28 days and meet the requirements of Byggvarubedömningen of the **Recommended class** regarding Emissions of VOC to the indoor environment.

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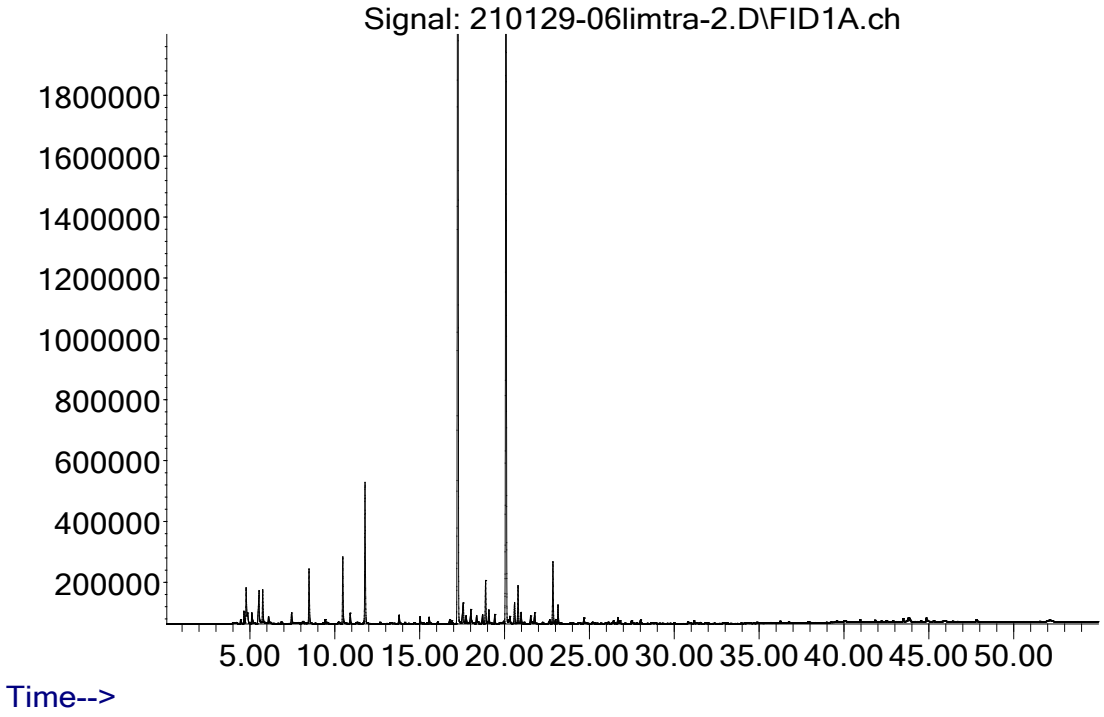
Appendices

1. Gas Chromatogram
2. Photo of the test specimen
3. Sampling report

Appendix 1

Gas chromatogram

Edge glued panel, after 28 days:



TVOC between C_6 and C_{16}, means compounds eluting between 6.2 and 38 minutes.

Appendix 2

Photo of the test specimen

Appendix 3

Sampling Report

Sampler (Name, Company, contact info):	**Manufacturer of the product** (Company, address): Ess-Enn Timber AB – Peter Gill Skruvbyvägen 365 94 Skruv Sweden
Name of product: Edge glued panel	**Type of product:** Shelving and subject for furniture manufacturing, glued together from lamellas in pine (Pinus sylvestris).
Manufacturing Date: 2020-12-07	**Batch No:** Taken from production order: 15030
Date of sampling:	**Amount/size of material sampled:** **Packing material:**
Sample is taken from: Production line ☒ Stock / Storage ☐ Miscellaneous ☐ -where, specify:	**How was the product stored before sampling?** The sample has not been stored. Taken directly from the production line.
If a sub-sample was collected from a larger material amount, describe how the sub-sample was taken:	
Observations and remarks:	
Confirmation I hereby confirm that the sample was selected, taken and packed in accordance with the instructions.	
Date:	**Signature:**