

Nobia Production Sweden AB
Erik Carlsson
Mossebogatan 6
522 81 Tidaholm

Emission measurements after 28 days

(3 appendices)

Object

One sample of a kitchen counter top was delivered to RISE from the customer.

Product name:	Bänkskiva Laminat
Production date:	2018-12-04
Size of sample:	one piece, 500 x 500 x 30 mm, wrapped in aluminium and plastic foil
Date of sampling:	2018-12-12
Date of arrival to RISE:	2018-12-14
Date of analysis:	week 51, 2018 – 05, 2019

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 (EU-LCI values).

For evaluation of test results the principle of shared risk is applied, i.e. for a max limit (\leq) a result \leq the limit complies and a result $>$ the limit does not comply (ILAC G8 section 2.7).

Method

The test was started 2018-12-20 by unwrapping the test piece. 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 2019-01-17.

RISE Research Institutes of Sweden AB

Postal address	Office location	Phone / Fax / E-mail
Box 857 SE-501 15 BORÅS Sweden	Brinellgatan 4 SE-504 62 BORÅS	+46 10 516 50 00 +46 33 13 55 02 info@ri.se

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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:	0.56 m ²
Air exchange rate:	0.5 h ⁻¹
Area specific air flow rate:	0.89 m ³ /m ² h.
Air velocity at specimen surface:	0.1 – 0.3 m/s

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/m³ 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 to 100 L.

Results

The results in Table 1 are expressed as area specific emission rates and as concentrations in a reference room (according to EN 16516:2017). 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 m², floor area is 12 m², small area, like a door, is 1.6 m² and very small area, like sealant, is 0.2 m². **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/m³
 E_a = area specific emission rate, in µg/m²h
 A = surface area of product in reference room, in m²
 n = air exchange rate, in changes per hour, here 0.5 h⁻¹
 V = volume of the reference room, in m³, here 30 m³

Table 1.
Emission results of **Bänkskiva Laminat** after 28 days

Volatile organic compounds	CAS number	Retention time (min)	ID ¹	Emission rate ($\mu\text{g}/\text{m}^2\text{h}$)	Concentration in reference room ($\mu\text{g}/\text{m}^3$)	LCI _i ($\mu\text{g}/\text{m}^3$)	R _i (c_i/LCI_i)
TVOC ($C_6 - C_{16}$)	--	6.9 – 39	B	16	< 10	--	--
Volatile Carcinogens ²		6.9 – 39					
No substances detected	--	--	B	< 1	< 1	--	--
VOC with LCI ³		6.9 – 39					
Hexanal	66-25-1	12.7	A	6	< 5	900	--
α -Pinene	80-56-8	18.3	A	9	< 5	2500	--
β -Pinene	127-91-3	20.1	A	2	< 5	1400	
3-Carene	13466-78-9	21.1	A	2	< 5	1500	--
Σ VOC with LCI	--	--	A	19	< 5	--	--
VOC without LCI ⁴		6.9 – 39					
No substances detected	--	--	B	< 2	< 5	--	--
Σ VOC without LCI	--	--	B	< 2	< 5	--	--
SVOC ($C_{16} - C_{22}$) ⁵		39 - 52					
No substances detected	--	--	B	< 2	< 5	--	--
Σ SVOC	--	--	B	< 2	< 5	--	--
VVOC ($< C_6$) ⁶		5.3 – 6.9					
Formaldehyde ⁷	50-00-0	--	A	22	< 5	100	--
Acetaldehyde ⁷	75-07-0	--	A	4	< 5	1200	--
Σ VVOC	--	--	A	26	< 5	--	--
$R = \Sigma C_i / \text{LCI}_i$ ⁸	--	--	--	--	--	--	< 0.01

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, July 2018

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 $2 \mu\text{g}/\text{m}^2\text{h}$ are listed in Table 1, carcinogenic compounds $\geq 1 \mu\text{g}/\text{m}^2\text{h}$. Only the compounds with a concentration in the reference room $> 5 \mu\text{g}/\text{m}^3$ are evaluated based on LCI (= lowest concentration of interest). TVOC expressed in $\mu\text{g}/\text{m}^3$ is the sum of all individual substances with concentrations $\geq 5 \mu\text{g}/\text{m}^3$ (in toluene equivalents). The emission rate of TVOC ($\mu\text{g}/\text{m}^2\text{h}$) includes all compounds $\text{ca} \geq 1 \mu\text{g}/\text{m}^2\text{h}$ in the chamber. Quantification limit for TVOC is $10 \mu\text{g}/\text{m}^2\text{h}$. Measurement uncertainty for VOC is 15 % (rel) and for formaldehyde 30 % (rel). Background of TVOC in the empty chamber was below $20 \mu\text{g}/\text{m}^3$ 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 **Bänkskiva Laminat**

Compounds	Emission rate ($\mu\text{g}/\text{m}^2\text{h}$)	Concentration in reference room (small area scenario) ($\mu\text{g}/\text{m}^3$)
TVOC	16	< 10
Σ Carcinogenic VOCs	< 1	< 1
Σ VOC with LCI	19	< 5
Σ VOC without LCI	< 2	< 5
Σ VVOC	26	< 5
Formaldehyde	22	< 5
Σ SVOC	< 2	< 5
$R = \Sigma C_i / \text{LCI}_i$	< 0.01	

Evaluation of the test results

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 formaldehyde. The requirements for the *Recommended class* is that the requirements to one of the following systems are being met: Emission class EC1, Emission class EC1^{PLUS}, Blue Angel, M1 (RTS) or GUT. The results of the tested sample are compared to M1.

According to M1 fixture door is tested in a size of 60 x 90 cm (area = 0.54 m²). In the calculation of the concentrations in the reference room 10 units are used with a total area of 5.4 m². In this comparison the area of 5.4 m² is used for the calculation of the concentrations of EU-LCI compounds in the reference room. See the calculated concentrations of EU-LCI in Table 3.

Table 3.

Concentrations of detected EU LCI-compounds according to M1 fixture door

Single VOCs	CAS number	Concentration ($\mu\text{g}/\text{m}^3$)	EU-LCI _i (July 2018) ($\mu\text{g}/\text{m}^3$)
Hexanal	66-25-1	< 5	900
α -Pinene	80-56-8	< 5	2500
β -Pinene	127-91-3	< 5	1400
3-Carene	13466-78-9	< 5	1500

Table 4.The test results of **Bänkskiva Laminat** compared to the relevant requirements in M1

Compounds	Requirement M1 ($\text{mg}/\text{m}^2\text{h}$)	Test Results ($\text{mg}/\text{m}^2\text{h}$)	Pass / Fail
TVOC	< 0.2	< 0.010 ⁹⁾	PASS
Formaldehyde	< 0.05	0.022	PASS
CMR 1A+1B	< 0.005	< 0.001	PASS
Single VOC ($\mu\text{g}/\text{m}^3$)	\leq EU-LCI	\leq EU-LCI	PASS
Ammonia	< 0.03	not measured	--
Odour	\geq 0.0	not measured	--

⁹⁾ According to M1: Only compounds $> 5 \mu\text{g}/\text{m}^3$ (in toluene equivalents) are included in TVOC. TVOC is here $< 10 \mu\text{g}/\text{m}^2\text{h}$.

The test results are in compliance with the tested requirements of M1 and meet the requirements for the *Recommended class*.

RISE Research Institutes of Sweden AB Chemistry and Materials - Chemistry

Performed by

Examined by

Maria Rådemar

Tove Mali'n

Appendices

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

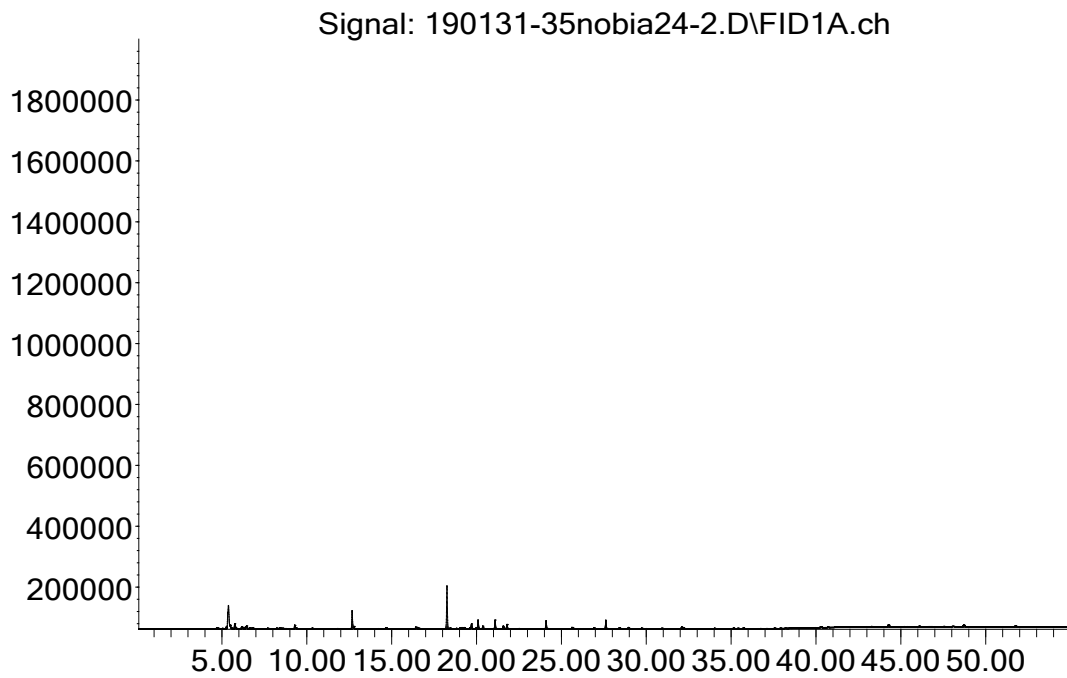
Appendix 1

Gas chromatogram

Bänkskiva Laminat, after 28 days:

Sampled volume = 5 L

Abundance



TVOC between C_6 and C_{16} , means compounds eluting between 6.9 and 39 minutes.

Appendix 2

Photo of the test specimen

Appendix 3

Sampling Report

Sampler (Name, Company, contact info): Yamina Helenius Nobia Production SE yamina.helenius@nobia.com +46 (0)502-17342	Manufacturer of the product (Company, address): Nobia Production SE Mossebogatan 6 522 81 Tidaholm
Name of product: Bänkskiva laminat Test sample:	Type of product: Kitchen interior Laminated countertop Various decors
Manufacturing Date: 2018-12-04	Batch No: MM622825
Date of sampling: 2018-12-12	Amount/size of material sampled: 1 pcs of size 500x500x30 mm Packing material: As requested
Sample is taken from: Production line <input type="checkbox"/> Stock / Storage <input type="checkbox"/> Miscellaneous <input type="checkbox"/> -where, specify: Directly from producer	How was the product stored before sampling? NA
If a sub-sample was collected from a larger material amount, describe how the sub-sample was taken:	
Observations and remarks: NA	
Confirmation I hereby confirm that the sample was selected, taken and packed in accordance with the instructions.	
Date: 2018-12-12	Signature: 