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Emission measurements after 28 days

(3 appendices)

Object

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

Product name: **Nordic HW top white**
Production date: October 2021
Size of sample: 1 L, tin can
Date of arrival to RISE: 2021-11-25
Date of analysis: week 47, 2021 – 02, 2022

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) and aldehydes (ISO 16000-3:2011). Evaluation according to EN 16516:2017/A1:2020 (EU-LCI values), and comparison to the emission requirements of Byggarubedömningen (version 6.0, 2021-07-01).

Method

The test was started 2021-11-25. The coating was applied with a paintroller on a glass plate of 0.040 m². Dry film thickness was calculated from given solid content and recommended spreading rate. With the dry film thickness, given density and the solid content the applied amount was calculated, Table 1.

Table 1.

Density (g/cm ³)	Solid Content (vol %)	Spreading rate (m ² /L)	Calculated dry film thickness (µm)	Film Thickness Class ¹	Applied amount (g)	Applied dry film thickness (µm)
1.20	45.86	12	38.2	40	4.22	40

¹) Film Thickness Class according to ISO 16000-11:2006(E), Part B.2.1.1 Classification of a paint product. Minimum= 5 µm, Low = 15 µm, Medium = 40 µm and High = 60 µm.

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

Test conditions in the chamber:

Chamber volume:	0.03 m ³
Temperature:	23 ± 0.5 °C
Relative humidity:	50 ± 3 % RH
Surface area of test specimen:	0.040 m ²
Air exchange rate:	0.64 h ⁻¹
Area specific air flow rate:	0.50 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 with 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 or 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 20 L.

Results

The results relate only to the items tested.

The results in Table 2 are expressed as area specific emission rates and as concentrations in a reference room (according 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 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. Wall 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 2.
Emission results **Nordic HW top white** after 28 days

Volatile organic compounds	CAS number	Retention time (min)	ID ¹	Emission rate (µg/m ² h)	Concentration in reference room (µg/m ³)	LCI _i (µg/m ³)	R _i (c _i /LCI _i)
TVOC (C₆ – C₁₆)	--	6.3 – 38	B	24	51	--	--
Volatile Carcinogens²		6.3 – 38					
No substances detected	--	--	B	< 1	< 1	--	--
VOC with LCI³		6.3 – 38					
2,2,4-Trimethyl-1,3-pentenediol monoisobutyrate	25265-77-4	32.0+32.6	A	41	85	850	0.100
∑ VOC with LCI	--	--	A			--	--
VOC without LCI⁴		6.3 – 38					
No substances detected	--	--	B	< 2	< 5	--	--
∑ VOC without LCI	--	--	B	< 2	< 5	--	--
SVOC (C₁₆ – C₂₂)⁵		38 - 51					
No substances detected	--	--	B	< 2	< 5	--	--
∑ SVOC	--	--	B	< 2	< 5	--	--
VVOC (< C₆)⁶		5.0 – 6.3					
Formaldehyde ⁷	50-00-0	--	A	< 2	< 5	100	--
Acetaldehyde ⁷	75-07-0	--	A	< 2	< 5	300	--
∑ VVOC	--	--	A	< 2	< 5	--	--
R = ∑ C_i / LCI_i⁸	--	--	--	--	--	--	0.10

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 2020

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) R_i is the ratio of c_i/LCI_i, where c_i is the concentration in the reference room for compound *i*.

All VVOC, VOC, SVOC and carcinogens with LCI are included in the calculation of R value.

Only the compounds with a concentration > 5 µg/m³ in the reference room are listed in Table 1 (carcinogenic compounds ≥ 1 µg/m³) and evaluated based on LCI (= lowest concentration of interest). TVOC expressed in µg/m³ is the sum of all individual substances with concentrations ≥ 5 µg/m³ in toluene equivalents.

The emission rate of TVOC (µg/m²h) includes all compounds ca ≥ 1 µg/m²h in the chamber.

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 3.

Table 3.

Summary of the emission results after 28 days of **Nordic HW top white**

Compounds	Emission rate ($\mu\text{g}/\text{m}^2\text{h}$)	Concentration in reference room (wall scenario) ($\mu\text{g}/\text{m}^3$)
TVOC	24	51
Σ Carcinogenic VOCs	< 1	< 1
Σ VOC with LCI	41	85
Σ VOC without LCI	< 2	< 5
Σ VVOC	< 2	< 5
Formaldehyde	< 2	< 5
Σ SVOC	< 2	< 5
$R = \Sigma C_i / \text{LCI}_i$	0.1	

Evaluation of the test results

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

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.

Byggarubedömningen (version 6.0, 2021-07-01) has criteria regarding Emissions of VOC 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 **M1** "M1 Emission Classification of Building Materials: Protocol for Chemical and Sensory Testing of Building Materials, ver 15.11.2017", see Table 4.

Table 4.

 The test results of **Nordic HW top white** compared to the relevant requirements in M1

Compounds	Requirement M1 (mg/m ² h)	Test Results (mg/m ² h)	Pass / Fail
TVOC	< 0.2	0.024	PASS
Formaldehyde	< 0.05	< 0.002	PASS
CMR 1A+1B	< 0.001	< 0.001	PASS
Single VOC (µg/m ³)	≤ EU-LCI	≤ EU-LCI	PASS
Ammonia	< 0.03	not measured	--
Odour	≥ 0.0	not measured	--

Results of evaluation:

The test results of TVOC, VOC and aldehydes are in compliance with the requirements of M1 after 28 days and meet the requirements of Byggsvarubedömningen of the **Recommended class** regarding Emissions of VOC to the indoor environment.

**RISE Research Institutes of Sweden AB
Chemistry and Applied Mechanics- Chemical Product Safety**

Performed by

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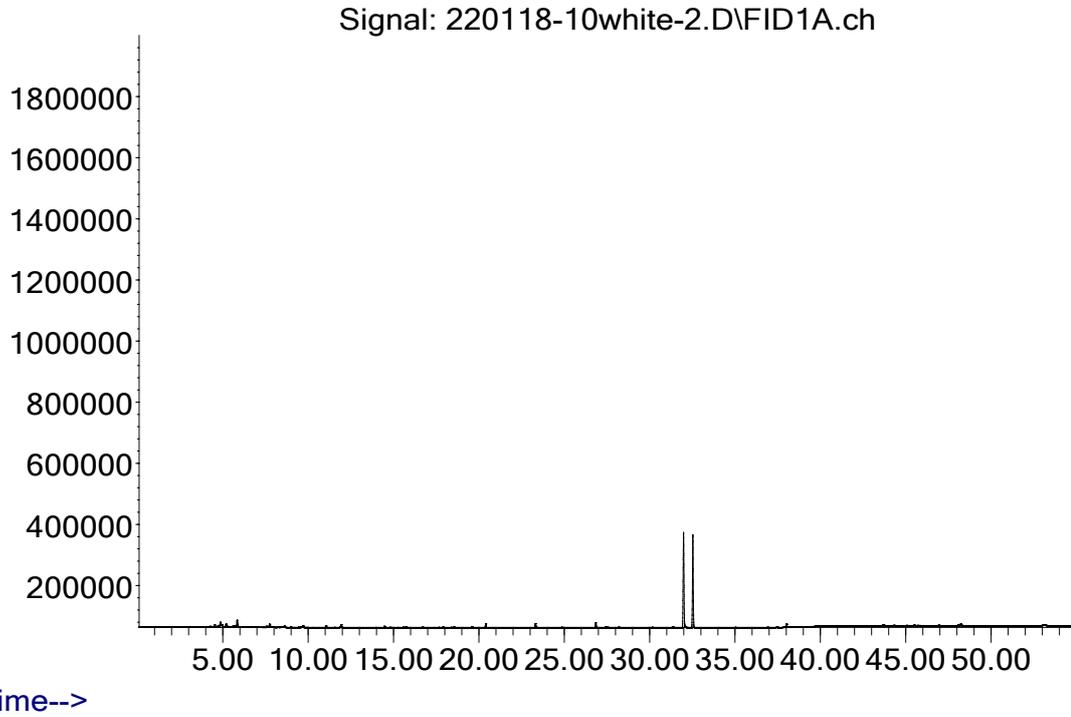
Appendices

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

Appendix 1

Gas chromatogram

Nordic HW top white, after 28 days:
Abundance



TVOC between C₆ and C₁₆, means compounds eluting between 6.3 and 38 minutes.

Appendix 2

Photo of the test specimen

Appendix 3

Sampling Report (paints etc)

Sampler (Name, Company, contact info): Scandinavian Trading Ltd, unit 2, Glen Court, Canada Road, Byfleet, Surrey, KT14 7JL, United Kingdom		Manufacturer of the product (Company, address): Intumescent Systems Ltd, Envirograf House, Barfrestone, Dover, Kent CT15 7JG, United Kingdom	
Name of product: Nordic HW top white		Product category according to EN 16402:2019, table 3: Function: water-based decorative topcoat	
Manufacturing Date: October 2021		Batch No: 214005	
Amount of material sampled: 1 lit		Density (g/L): 1.20 g/cm ³	
Solid content (vol %): 45.86%		Spreading rate (m²/L): 1 -2 coats of 85 μ Total spreading rate 12 m ² /lit	
Sample is taken from: Production line <input type="checkbox"/> Stock / Storage <input checked="" type="checkbox"/> Miscellaneous <input type="checkbox"/> -where, specify:		How was the product stored before sampling? Indoor environment	
If a sub-sample was collected from a larger material amount, describe how the sub-sample was taken:		Packing material: Metal tin	
Remarks: UK Manufacturers name for the product is HW Premier White. Distributed in Sweden as Nordic HW top vit , in Norway as Nordic HW top hvit .			
Confirmation: I hereby confirm that the sample was selected, taken and packed in accordance with this protocol.			
Date of sampling: 13.11.2021		Signature: 