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## Emission measurements according to M1 classification (1 appendix)

### Assignment

At the request of Huntonit AS an emission measurement according to "Emission Classification of Building Materials: Protocol for Chemical and Sensory Testing of Building Materials", ver 15.12.2004, has been carried out.

The measurements are made after 28 days of conditioning regarding volatile organic compounds, formaldehyde, ammonia and odour.

### Product/test specimen

Product type:	Interior wood panel, roof
Product name:	<b>Huntonit Antikk tak</b>
Batch:	White, No: 29721180, 060510
Packaging:	7 tiles of 0.6 x 0.6 m, wll wrapped in plastic foil
Arrived at SP:	24 <sup>th</sup> May 2010
Test specimen preparation:	Five boards from middle of the package were taken.  Chemical testing: 2 boards, backsides, edges and small part of front sides were covered with aluminium foil and aluminium tape to receive specimens with an open surface of 0.20 m <sup>2</sup> each.  Sensory testing: 3 boards, backsides, edges and small part of front sides were covered with aluminium foil and aluminium tape to receive specimens with an open surface of 0.23 m <sup>2</sup> each.
Deviation from protocol:	No deviations
Test period started, date:	31 <sup>th</sup> May 2010
Conditions during ageing:	23 ± 2 °C, 50 ± 5 % RH
Emission sampling, date:	28 <sup>th</sup> June 2010

### Methods

The specimens were conditioned outside the testing chambers in controlled climate conditions of 23 ± 2 °C and 50 ± 5 % RH. The specimens were placed in the chambers four days before the measurements.

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Chamber conditions of the test of volatile organic compounds, formaldehyde and ammonia:

Test chamber volume:	1.0 m <sup>3</sup> , stainless steel
Area of sample:	0.4 m <sup>2</sup>
Air exchange rate:	0.5 h <sup>-1</sup>
Area specific air flow rate:	1.25 m <sup>3</sup> /m <sup>2</sup> h
Temperature:	23 ± 1 °C
Relative Humidity:	50 ± 3 % RH

Chamber conditions of the test of odour:

Test chamber volume:	1.0 m <sup>3</sup> , stainless steel
Area of sample:	0.68 m <sup>2</sup>
Supply air flow rate:	0.9 l/s = 3.24 m <sup>3</sup> /h
Temperature:	23 ± 1 °C
Relative Humidity:	50 ± 3 % RH

Emission sampling and analytical methods:

Test	Method	Adsorbent	Sampling volume (litre)	Quantification / Analysis method	Detection limit
VOC	SP 0601 <sup>1</sup>	Tenax TA	4 - 13	FID quantification	1 µg/m <sup>3</sup>
Formaldehyde	SP 2302 <sup>2</sup>	DNPH	100	HPLC/UV	0.03 µg/sampler
Ammonia	<sup>3</sup>	Silica gel	160 - 200	Spectrophotometric	0.9 µg/sampler
Sensory evaluation	Human nose	--	--	--	--

<sup>1)</sup> In accordance with ISO 16000-6:2004.

<sup>2)</sup> In accordance with ISO 16000-3:2001.

<sup>3)</sup> Sampling according to NIOSH 6016: 1996 and analysis according 4500-NH<sub>3</sub> Phenate method.

Tenax TA was used as adsorption medium for VOC. The Tenax tubes were thermally desorbed and analysed in accordance to ISO 16000-6:2004 (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), SP method 0601. This means an analysis in a gas chromatograph and detection with a flame ionisation detector (FID) and mass selective detector (MS). The FID signals are used for compound quantification. The TVOC is quantified as toluene equivalents. The mass selective detector is used for identification of compounds.

Tenax TA was also used as adsorption medium for testing of volatile carcinogenic compounds, according to IARC listing, category 1 (exclusive formaldehyde), 0.001 mg/m<sup>2</sup>h and above.

The sampling of formaldehyde was carried out with DNPH samplers. The samplers were analysed according to ISO 16000-3 (in accordance to accredited SP method 2302), which means analysis on a liquid chromatograph with absorbance detector.

The sampling of ammonium was carried out with silicagel treated adsorbent tubes (according NIOSH 6016: 1996) and analysis according 4500-NH<sub>3</sub> Phenate method (spectrophotometric method), not accredited method.

Three subsequent samples were taken for the VOC determination, two samples for formaldehyde and ammonia respectively.

## Results

The results of the chemical testing are expressed as concentrations in the chamber and area specific emission rates:

$$SER_A = \frac{Conc \times n}{L}$$

$SER_a$  = area specific emission rate, in  $mg/m^2h$

Conc = concentration of a volatile compound in the chamber, in  $mg/m^3$

n = air exchange rate, in changes per hour

L = loading factor, in  $m^2/m^3$  (area of sample/volume of chamber)

Results of the chemical testing of the sample of **Huntonit Antikk tak** after 28 days:

Compound	Concentration $mg/m^3$	Emission rate $mg/m^2h$	Criteria M1 $mg/m^2h$
TVOC	0.058	<b>0.072</b>	< 0.2
Carcinogens	< 0.002	< <b>0.002</b>	< 0.005
Formaldehyde	< 0.001	< <b>0.001</b>	< 0.05
Ammonia	< 0.005	< <b>0.006</b>	< 0.03

See appendix 1 for gas chromatogram from VOC determination.

Results of the sensory evaluation of the sample of **Huntonit Antikk tak** after 28 days:

Evaluator	Sensory evaluation		Average of acceptability	Criteria M1
	first	second		
1	+0.80	+0.85	+ 0.5	$\geq + 0.1$
2	+0.15	+0.20		
3	-0.25	-0.25		
4	+0.80	+0.80		
5	+0.65	+0.40		
6	+0.90	+0.90		

## Interpretation of the results

The tested product **Huntonit Antikk tak** complies with the requirements of M1 for the tested parameters.

## Detailed results

Detailed results of the chemical testing after 28 days:

Sample	TVOC $mg/(m^2h)$ as toluene equivalents between $C_6-C_{16}$	Formaldehyde $mg/(m^2h)$	Ammonia $mg/(m^2h)$	Carcinogens <sup>4</sup> $mg/(m^2h)$ as toluene equivalents between $C_6-C_{16}$
1	0.070	< 0.001	< 0.006	< 0.002
2	0.072	0.001	< 0.006	< 0.002
3	0.067	--	--	< 0.002

<sup>4)</sup> The emission of which exceeds  $0.002 mg/(m^2h)$ .

Single VOCs of which exceed 0.005 mg/(m <sup>2</sup> h) as toluene equivalent	Retention time (min)	CAS number	Emission rate (mg/m <sup>2</sup> h)		
			Sample 1	Sample 2	Sample 3
<b>Single VOCs C<sub>6</sub>-C<sub>16</sub>:</b>	5.0 – 36.0				
Ethanol, 2-(2-butoxyethoxy)-	24.3	112-34-5	0.014	0.016	0.014
Probably: Tripropylene Glycol	25.8 + 25.9	1638-16-0	0.032	0.036	0.033
		TVOC:	0.070	0.072	0.067
<b>Single VOC outside C<sub>6</sub> – C<sub>16</sub>:</b>					
VVOC (< C <sub>6</sub> ) <sup>5</sup>	3.5 – 5.0				
No single VOC detected	--	--	--	--	--
SVOC (C <sub>16</sub> – C <sub>22</sub> ) <sup>6</sup>	36.0 - 44.0				
No single VOC detected	--	--	--	--	--

<sup>5)</sup> VVOC = very volatile organic compounds, as defined in ISO 16000-6

<sup>6)</sup> SVOC = semi-volatile organic compounds, as defined in ISO 16000-6

Level of identification of compounds is 100 % for all compounds  $\geq$  0.005 mg/(m<sup>2</sup>h).

### Measurements uncertainty

SER <sub>TVOC</sub>	$\pm 15 \%$
SER <sub>NH3</sub>	$\pm 25 \%$ <sup>7</sup>
SER <sub>Formaldehyde</sub>	$\pm 30 \%$

<sup>7)</sup> Based on measurements uncertainty regarding sampling according to accredited SP method 1314 (Sampling of emissions of VOC, formaldehyde and ammonia from materials in an 1 m<sup>3</sup> test chamber).

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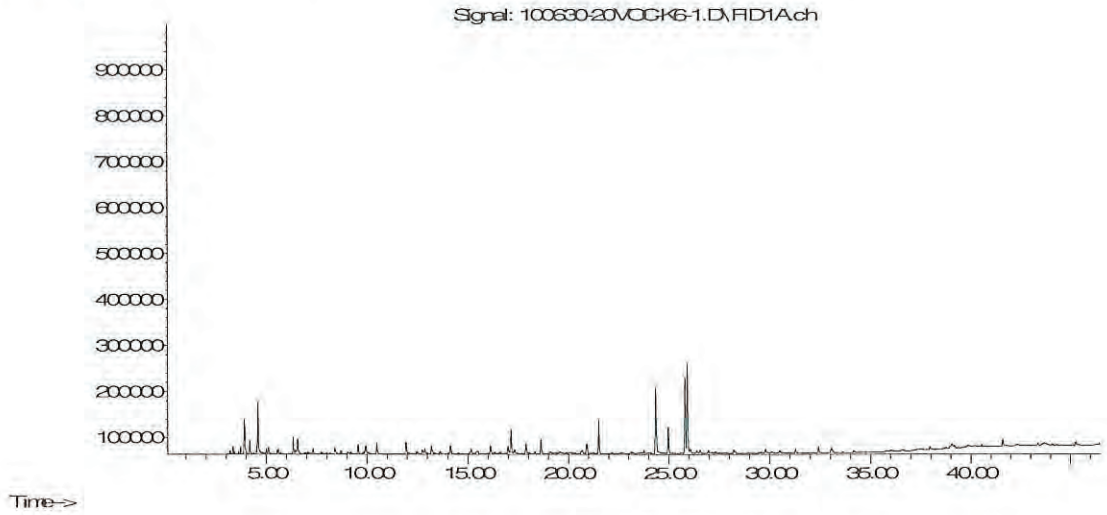
### Appendix

1. Gas chromatograms

**Gas chromatogram**

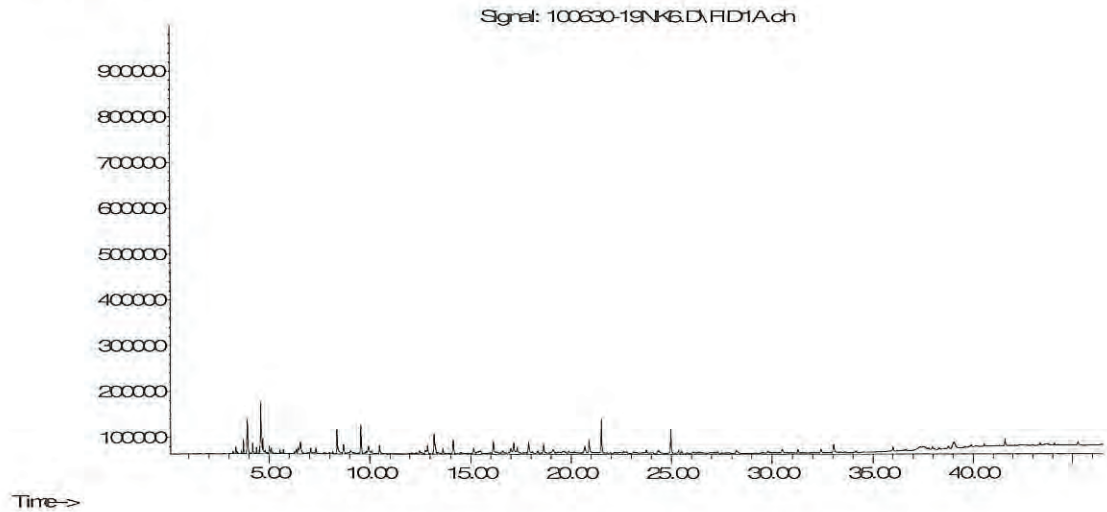
Sample: **Huntonit Antikk tak**, after 28 days (sampled volume: 5.5 litre):

Abundance



Sample: Empty chamber (sampled volume: 12.0 litre):

Abundance



$$\text{TVOC}_{\text{empty chamber}} = 13.8 \mu\text{g}/\text{m}^3$$