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## BREEAM Norway Test Report

### 1 Sample Information

Sample identification	GRAFT FR Board (coating component)
Batch no.	-
Production date	-
Product type	Coating
Date when sample was received	02-01-2014
Testing (start - end)	13-01-2014 – 10-2-2014

### 2 Evaluation of the Results

The tested product complies with the requirements of BREEAM Norway according to M1 Protocol for Chemical and Sensory Testing of Building Materials as published by Rakennustietosäätiö RTS (version 15.12.2004).

Parameter	Determined area specific emission rate mg/m <sup>2</sup> h	Limit value mg/m <sup>2</sup> h
TVOC	0.2	≤ 0.2
Formaldehyde	0.0031	≤ 0.05
Ammonia	< 0.005	≤ 0.03
Carcinogenic com-	< 0.001	≤ 0.005



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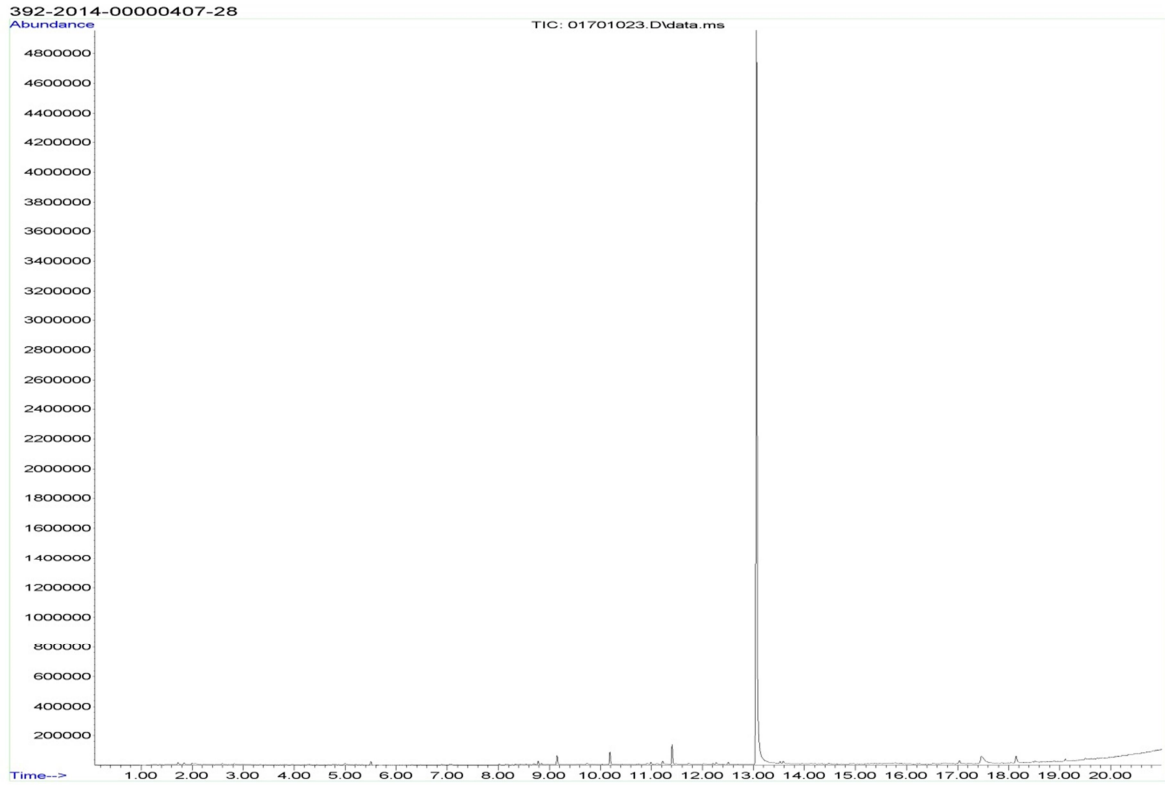
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## 3 Test Method

Method	Principle	Parameter	Quantification limit	Uncertainty	
BREEAM (200); EN 13999-1, -2, -3, -4,					
Internal method numbers: 9810, 9811, 9812, 2808, 8400	GC/MS	VVOC, VOC, SVOC	5 µg/m <sup>3</sup>	22% (RSD) U <sub>m</sub> = 2 x RSD = 45 %	
	HPLC	Volatile Aldehydes	4 µg/m <sup>3</sup>		
<b>Test chamber parameter</b>					
Chamber volume, l	119	Temperature, °C	23±1	Relative humidity, %	50±5
Air exchange rate, 1/h	0.5	Loading ratio, m <sup>2</sup> /m <sup>3</sup>	1		
The sample was homogenised and applied onto a glass plate using 132 g/m <sup>2</sup> .					
<b>Deviations from the test method:</b>		None			

## 4 Appendix

### 4.1 Chromatogram after 28 days



## 4.2 Description of the applied test method

The applied method complies with the Protocol for Chemical and Sensory Testing of Building Materials as defined by the Finnish Emission Classification of Building Materials (version of 2004). The test method is based on the published methods: ISO 16000-3, ISO 16000-6, 16000-9, 16000-11. The internal method numbers are: 9810, 9811, 9812, 2808, 4430 and 8400.

### 4.2.1 Test Chamber

- **Chemical Testing:** The test chamber was consisting of stainless steel. The air clean-up was realized in multiple steps. Before loading the chamber a blank check of the empty chamber was performed. The operation parameters were 23 °C, 50 % relative air humidity (in the supply air) with an air exchange rate of ½ per hour.
- **Sensory Testing:** The test chamber was a "BIG-PAC" chamber made of glass and had a volume of 200 litres. The air clean-up was realized in multiple steps. Before loading the chamber, a blind check of the empty chamber was performed.

### 4.2.2 Sampling, Desorption, Analyses

All emissions were calculated as area specific emission rate SER with the following formula:

$$\text{SER} = C \times n / L$$

With:

- C Concentration in test chamber,  $\mu\text{g}/\text{m}^3$
- n Air exchange rate, 1/h
- L Loading factor,  $\text{m}^2/\text{m}^3$

### 4.2.3 Testing of Carcinogens after 28 Days

The presence of volatile organic carcinogens (IARC 1987 listing, category C1, 1  $\mu\text{g}/\text{m}^2\text{xh}$  and above), which means benzene and vinyl acetate, was tested.

The test was done by drawing air samples from the chamber outlet through Tenax TA tubes (main tube and backup tube) after 28 days. Analyses were done by thermal desorption and gas chromatography / mass spectroscopy (internal methods: 9812 / 2808).

The absence of a listed carcinogen was stated if the specific combination of fragment ions was lacking at the specific retention time in the chromatogram. Otherwise it was checked whether the required detection limit (1  $\mu\text{g}/\text{m}^2\text{xh}$ ) was exceeded. In this case the identity was finally checked by comparing full scan sample mass spectra with full scan standard mass spectra.

### 4.2.4 Testing of VOC, SVOC, VVOC after 28 Days

The emissions of organic compounds after 28 days were tested by drawing air samples from the chamber outlet through Tenax TA tubes (main tube and backup tube). Analyses were done by thermal desorption and gas chromatography / mass spectroscopy (internal methods: 9812 / 2808).

Quantification was done with the Total Ion Chromatogram (TIC) signal, or in case of overlapping peaks by calculating with fragment ions. All identified and non-identified substances were quantified as toluene equivalent.

The results of the individual substances were calculated in three groups depending on their appearance in a gas chromatogram when analysing with a non-polar column (HP-1):

- Volatile organic compounds VOC: All substances appearing between these limits.
- Very volatile organic compounds VVOC: All substances appearing before n-hexane (n-C<sub>6</sub>).
- Semi-volatile organic compounds SVOC: All substances appearing after n-hexadecane (n-C<sub>16</sub>).

Calculation of the TVOC (Total Volatile Organic Compounds) was done by addition of the results of all substances between C<sub>6</sub> and C<sub>16</sub> as toluene equivalent, as defined in ISO 16000-6.

Calculation of the TSVOC (Total Semi-Volatile Organic Compounds) was done by addition of the results of all substances between C<sub>16</sub> and C<sub>22</sub> as toluene equivalent, as defined in ISO 16000-6.

Calculation of the TVVOC (Total Very Volatile Organic Compounds) was done by addition of the results of all substances appearing before C<sub>6</sub> as toluene equivalent, as defined in ISO 16000-6.

This test covered only substances that can be adsorbed on Tenax TA and that can be thermally desorbed. If other emissions occurred then these could not be monitored (or with limited reliability only).

#### 4.2.5 Testing of Formaldehyde after 28 Days

The presence of formaldehyde was tested by drawing air samples from the chamber outlet through DNPH-coated silicagel tubes after 28 days. Analysis was done by solvent desorption, HPLC and UV-/diode array detection (ISO 16000-3, internal methods: 9812 / 8400).

The absence of formaldehyde was stated if the specific wavelength UV detector response was lacking at the specific retention time in the chromatogram. Otherwise it was checked whether the detection limit was exceeded. In this case the identity was finally checked by comparing full scan sample UV spectra with full scan standard UV spectra.

#### 4.2.6 Testing of Ammonia after 28 days

The presence of ammonia was tested by drawing air samples from the chamber outlet through silicagel tubes coated with sulphuric acid after 28 days. Analysis was done by solvent desorption and UV/VIS spectroscopy (internal methods: 9812 / 4430).

The absence of ammonia was stated if the signal was lacking at the specific wavelength. Otherwise it was checked whether the detection limit was exceeded.

#### 4.2.7 Deviations from the M1 Test Method

No deviations.

#### 4.2.8 Accreditation

The testing methods described above have been accredited (ISO 17025-1) by DANAK (no. 522). But some parameters are not yet covered by that accreditation. At present the accreditation does not cover the parameters marked with a note \*. But the analysis was done for these parameters at the same level of quality as for the accredited parameters.

#### 4.2.9 Uncertainty of the test method

The relative standard deviation of the test method is amounted to 22% (RSD). The expanded uncertainty U<sub>m</sub> is 45% and equals 2 x RSD%, see also [www.eurofins.dk/uncertainty](http://www.eurofins.dk/uncertainty). This uncertainty does not include sensory testing.