

FireSeal AB  
Box 7091  
164 07 KISTA

## Emission measurements after 28 days

(3 appendices)

### Test object

One sample of an intumescent material was delivered to RISE by the customer.

Product name:	<b>Fire Barrier</b>
Manufacturer:	FireSeal AB
Manufacturing date:	2021-06-21
Batch No:	Pilot Batch
Size of sample:	Two pieces, each approx. 20 x 6 cm
Packing material:	Plastic foil and cardboard
Date of arrival to RISE:	2021-07-07

### 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 on July 12. One of the sample pieces was unpacked and used as received. 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  $23 \pm 2$  °C and  $50 \pm 5$  % 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 August 9.

Test conditions in the chamber:

Chamber volume:	0.031 m <sup>3</sup>
Temperature:	$23 \pm 0.5$ °C
Relative humidity:	$50 \pm 5$ % RH
Surface area of test specimen:	0.025 m <sup>2</sup>
Air exchange rate:	0.68 h <sup>-1</sup>
Area specific air flow rate:	0.84 m <sup>3</sup> /m <sup>2</sup> 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 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 2.6 to 7.1 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<sup>3</sup> and above.

The samplings of aldehydes were carried out with DNPH samplers. The samplers were analysed according to SP 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 1 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<sup>-1</sup>. The wall area is 31.4 m<sup>2</sup>, floor area is 12 m<sup>2</sup>, small area, like a door, is 1.6 m<sup>2</sup> and very small area, like sealant, is 0.2 m<sup>2</sup>. Very 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<sup>3</sup>

E<sub>a</sub> = area specific emission rate, in µg/m<sup>2</sup>h

A = surface area of product in reference room, in m<sup>2</sup>

n = air exchange rate, in changes per hour, here 0.5 h<sup>-1</sup>

V = volume of the reference room, in m<sup>3</sup>, here 30 m<sup>3</sup>

**Table 1.**  
Emission results of **Fire Barrier** after 28 days

Volatile organic compounds	CAS number	Retention time (min)	ID <sup>1</sup>	Emission rate ( $\mu\text{g}/\text{m}^2\text{h}$ )	Concentration in reference room ( $\mu\text{g}/\text{m}^3$ )	LCI <sub>i</sub> ( $\mu\text{g}/\text{m}^3$ )	R <sub>i</sub> ( $c_i/\text{LCI}_i$ )
<b>TVOC</b> (C <sub>6</sub> – C <sub>16</sub> )	--	6.2 – 38	B	< 10	< 5	--	--
<b>Volatile Carcinogens</b> <sup>2</sup>		6.2– 38					
No substances detected	--	--	B	< 1	< 1	--	--
<b>VOC with LCI</b> <sup>3</sup>		6.2 – 38					
No substances detected	--	--	A	< 2	< 5	--	--
$\Sigma$ VOC with LCI	--	--	A	< 2	< 5	--	--
<b>VOC without LCI</b> <sup>4</sup>		6.2 – 38					
No substances detected	--	--	B	< 2	< 5	--	--
$\Sigma$ VOC without LCI	--	--	B	< 2	< 5	--	--
<b>SVOC</b> (C <sub>16</sub> – C <sub>22</sub> ) <sup>5</sup>		38 - 51					
No substances detected	--	--	B	< 2	< 5	--	--
$\Sigma$ SVOC	--	--	B	< 2	< 5	--	--
<b>VVOC</b> (< C <sub>6</sub> ) <sup>6</sup>		5.4 – 6.2					
Formaldehyde <sup>7</sup>	50-00-0	--	A	4	< 1	100	--
Acetaldehyde <sup>7</sup>	75-07-0	--	A	< 1	< 1	1 200	--
$\Sigma$ VVOC	--	--	A	4	< 5	--	--
$R = \Sigma C_i / \text{LCI}_i$ <sup>8</sup>	--	--	--	--	--	--	< 0.01

<sup>1</sup>) ID: A = quantified compound specific, B = quantified as toluene-equivalent

<sup>2</sup>) Volatile carcinogens = VOCs according to EU Regulation No 1272/2008 Annex VI, cat 1A and 1B

<sup>3</sup>) VOC with LCI = identified VOC-compound with LCI-value according to EU-LCI, Dec 2020

<sup>4</sup>) VOC without LCI = VOC-compound without LCI-value or not identified.

<sup>5</sup>) SVOC = semi-volatile organic compounds, as defined in ISO 16000-6 (not part of accreditation)

<sup>6</sup>) VVOC = very volatile organic compounds, as defined in ISO 16000-6 (not part of accreditation)

<sup>7</sup>) VVOC-aldehydes measured with DNPH samplers (ISO 16000-3)

<sup>8</sup>) 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 in  $\mu\text{g}/\text{m}^3$  is the sum of all individual substances with concentrations (in toluene equivalents)  $\geq 5 \mu\text{g}/\text{m}^3$  in the reference room.

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 **Fire Barrier**

Compounds	Emission rate ( $\mu\text{g}/\text{m}^2\text{h}$ )	Concentration in reference room (very small area) ( $\mu\text{g}/\text{m}^3$ )
TVOC	< 10	< 5
$\Sigma$ Carcinogenic VOCs	< 1	< 1
$\Sigma$ VOC with LCI	< 2	< 5
$\Sigma$ VOC without LCI	< 2	< 5
$\Sigma$ VVOC	4	< 5
Formaldehyde	4	< 1
$\Sigma$ SVOC	< 2	< 5
$R = \Sigma C_i / LCI_i$	< 0.01	

## Evaluation of the test results

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

The results of the tested sample are compared to BREEAM Norway (2016, issue 1.1) requirements in Hea 02 Indoor air quality.

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 **Fire Barrier** are compared to the requirements in BREEAM Norway (2016, issue 1.1)

Compounds	Requirement ( $\mu\text{g}/\text{m}^3$ )	Test Results (very small area) ( $\mu\text{g}/\text{m}^3$ )	Pass / Fail
TVOC	< 60	< 5	<b>PASS</b>
Formaldehyde	< 10	< 1	<b>PASS</b>
CMR 1A+1B	< 1	< 1	<b>PASS</b>

## Conclusion

The test results are in compliance with the requirements of BREEAM Norway (2016, issue 1.1).

## **RISE Research Institutes of Sweden AB** **Chemistry, Biomaterials and Textiles - Chemical and Biological Safety**

Performed by

Examined by

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## Appendices

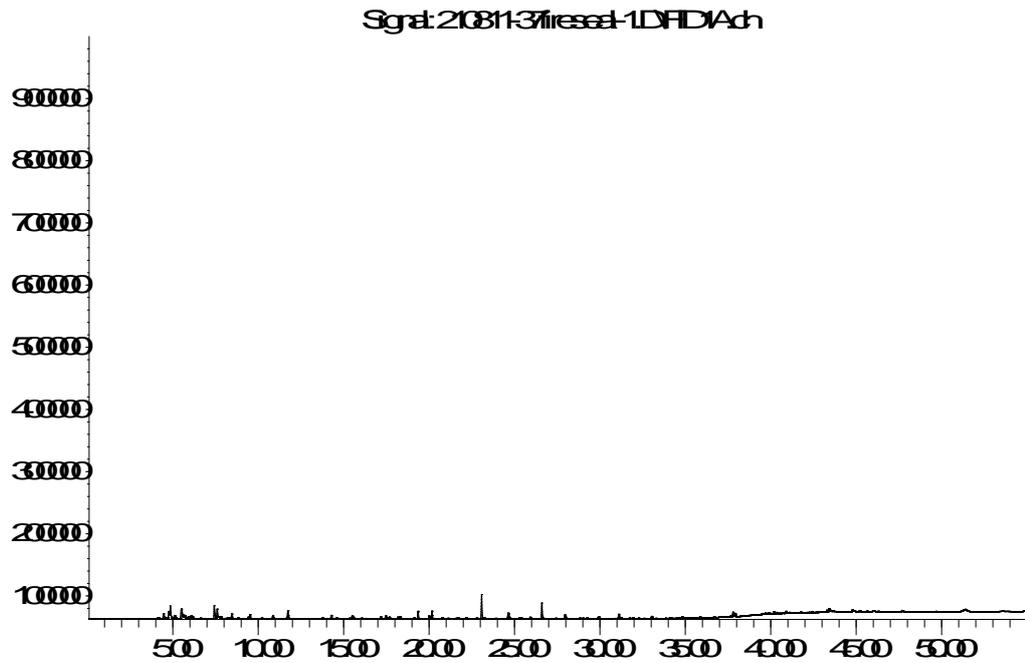
1. Gas Chromatogram
2. Photo of the test specimen
3. Sampling report

Appendix 1

**Gas chromatogram**

**Fire Barrier**, after 28 days:

**Abundance**



**Time->**

TVOC between C<sub>6</sub> and C<sub>16</sub>, means compounds eluting between 6.2 and 38 minutes.

## Appendix 2

**Photo of the test specimen**

Appendix 3

**Sampling Report**

<b>Sampler (Name, Company, contact info):</b> Fire Seal AB	<b>Manufacturer of the product (Company, address):</b> Fire Seal Esbogatan 14 16474 Kista
<b>Name of product:</b> Fire Barrier	<b>Type of product:</b> Svällband
<b>Manufacturing Date:</b> 21/6-21	<b>Batch No:</b> Pilot batch
<b>Date of sampling:</b>	<b>Amount/size of material sampled:</b> 20 x 55 cm  <b>Packing material:</b>
<b>Sample is taken from:</b> Production line <input type="checkbox"/> Stock / Storage <input type="checkbox"/> Miscellaneous <input checked="" type="checkbox"/> -where, specify: Pilot batch	<b>How was the product stored before sampling?</b> Normal rumstemperatur
<b>If a sub-sample was collected from a larger material amount, describe how the sub-sample was taken:</b>	
<b>Observations and remarks:</b>	
<b>Confirmation</b> I hereby confirm that the sample was selected, taken and packed in accordance with the instructions.	
<b>Date:</b> 28/6-21	<b>Signature:</b> 