REPORT

Issued by an Accredited Testing Laboratory

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Date	Reference	Page
2022-04-29	O100152-1108539	1 (5)

Täby Brandskyddsteknik AB
Okvistavägen 13
186 40 VALLENTUNA

Emission measurements after 28 days

(3 appendices)

Test object

A sample of a gypsum fire protection compound was delivered to RISE by the customer.

Product name:	**TBT Firestop Compo**
Manufacturing date:	2022-02-15
Batch No:	2022-02-15
Sampling date:	2022-03-03
Size of sample:	8 L
Package:	Plastic bucket
Date of arrival to RISE:	2022-03-07
Date of analyses:	week 14 – 17, 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), formaldehyde and acetaldehyde (ISO 16000-3:2011). Reference room calculations according to EN 16516:2017/A1:2020 (EU-LCI values).

Method

The test was started March 10, 2022. The gypsum powder was mixed thoroughly with water; 200 ml powder was added to 100 ml water. The compound was applied with a spatula in a frame with diameter 150 mm on a glass plate to a thickness of 3 mm. Total applied amount was 90.1 g. The specimen was then placed in a separate conditioning container (with air velocity of approx. 0.2 m/s) in a room with controlled climate conditions of 23 ± 2 ºC 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 2022-04-07.

Test conditions in the chamber:

Chamber volume:	0.031 m^3
Temperature:	23 ± 0.5 ºC
Relative humidity:	50 ± 5 % RH
Surface area of test specimen:	0.0177 m^2
Air exchange rate:	0.68 h^{-1}
Area specific air flow rate:	1.19 m^3/m^2 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 2.5 to 6.9 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^3 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 not accredited method). 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 m^2, floor area is 12 m^2, small area, like a door, is 1.6 m^2 and very small area, like sealant, is 0.2 m^2. 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^3
E_a = area specific emission rate, in µg/m^{2}h
A = surface area of product in reference room, in m^2
n = air exchange rate, in changes per hour, here 0.5 h^{-1}
V = volume of the reference room, in m^3, here 30 m^3

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Table 1.
Emission results of the product **TBT Firestop Compo** after 28 days

Volatile organic compounds	CAS number	Retention time (min)	ID[1]	Emission rate (µg/m²h)	Concentration in reference room (µg/m³)	LCI_i (µg/m³)	R_i (c_i/LCI_i)
TVOC ($C_6 - C_{16}$)	--	6.2 – 38	B	< 10	< 5	--	--
Volatile Carcinogens [2]		6.2– 38					
No substances detected	--	--	B	< 1	< 1	--	--
VOC with LCI [3]		6.2 – 38					
No substances detected	--	--	A	< 2	< 5	--	--
∑ **VOC with LCI**	--	--	A	< 2	< 5	--	--
VOC without LCI [4]		6.2 – 38					
No substances detected	--	--	B	< 2	< 5	--	--
∑ **VOC without LCI**	--	--	B	< 2	< 5	--	--
SVOC ($C_{16} - C_{22}$) [5]		38 - 51					
No substances detected	--	--	B	< 2	< 5	--	--
∑ **SVOC**	--	--	B	< 2	< 5	--	--
VVOC (< C_6) [6]		5.4 – 6.2					
Formaldehyde [7]	50-00-0	--	A	1	< 5	100	--
Acetaldehyde [7]	75-07-0	--	A	< 1	< 5	300	--
∑ **VVOC**	--	--	A	< 2	< 5	--	--
R = ∑ C_i / 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, Dec 2021
[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 µg/m²h are listed in Table 1, carcinogenic compounds ≥ 1 µg/m²h. Only the compounds with a concentration in the reference room > 5 µg/m³ are 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) in the reference room. The emission rate of TVOC (µg/m²h) includes all compounds of approx. ≥ 1 µg/m²h in the emission 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.

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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 for the product **TBT Firestop Compo**

Compounds	**Emission rate** ($\mu g/m^2h$)	**Concentration in reference room** ($\mu g/m^3$)
TVOC	< 10	< 5
∑ Carcinogenic VOCs	< 1	< 1
∑ VOC with LCI	< 2	< 5
∑ VOC without LCI	< 2	< 5
∑ VVOC	< 2	< 5
Formaldehyde	1	< 5
∑ SVOC	< 2	< 5
$R = \sum C_i / LCI_i$	< 0.01	

Evaluation of the test results

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

Byggvarubedömningen (version 5.0, updated 2021-01-01) 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 3.

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.

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Table 3.
The test results of the product **TBT Firestop Compo** compared to the relevant requirements in M1

Compounds	Requirement M1 **(very small area)** (mg/m^3)	Test Results (mg/m^3)	Pass / Fail
TVOC	< 0.02	**< 0.005**	**PASS**
Formaldehyde	< 0.01	**< 0.005**	**PASS**
CMR 1A+1B	< 0.001	**< 0.001**	**PASS**
Single VOC ($\mu g/m^3$)	≤ EU-LCI	**≤ EU-LCI**	**PASS**
Ammonia	< 0.01	not measured	--
Odour	≥ 0.0	not measured	--

Conclusion

The test results of TVOC, VOC and formaldehyde are in compliance with the requirements of M1 after 28 days and meet the requirements of Byggvarubedömningen 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

Ulrika Johansson

Examined by

Marcus Gjertz

Appendices

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

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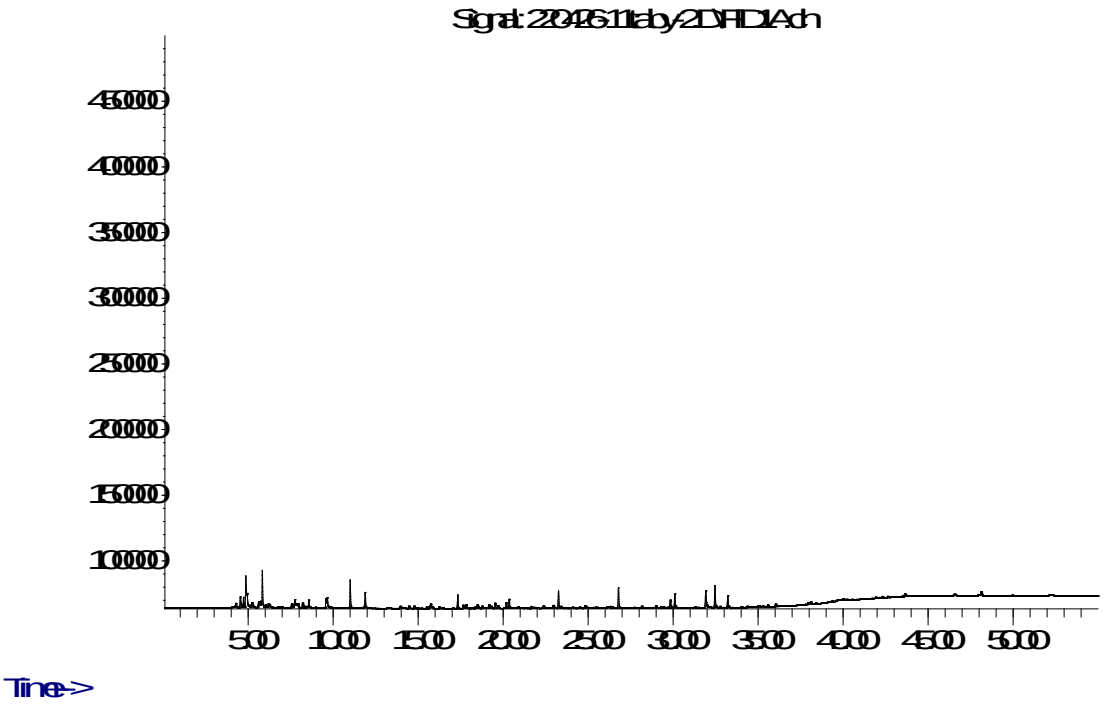
Appendix 1

Gas chromatogram

TBT Firestop Compo, after 28 days:



TVOC between C_6 and C_{16}, means compounds eluting between 6.2 and 38 minutes.

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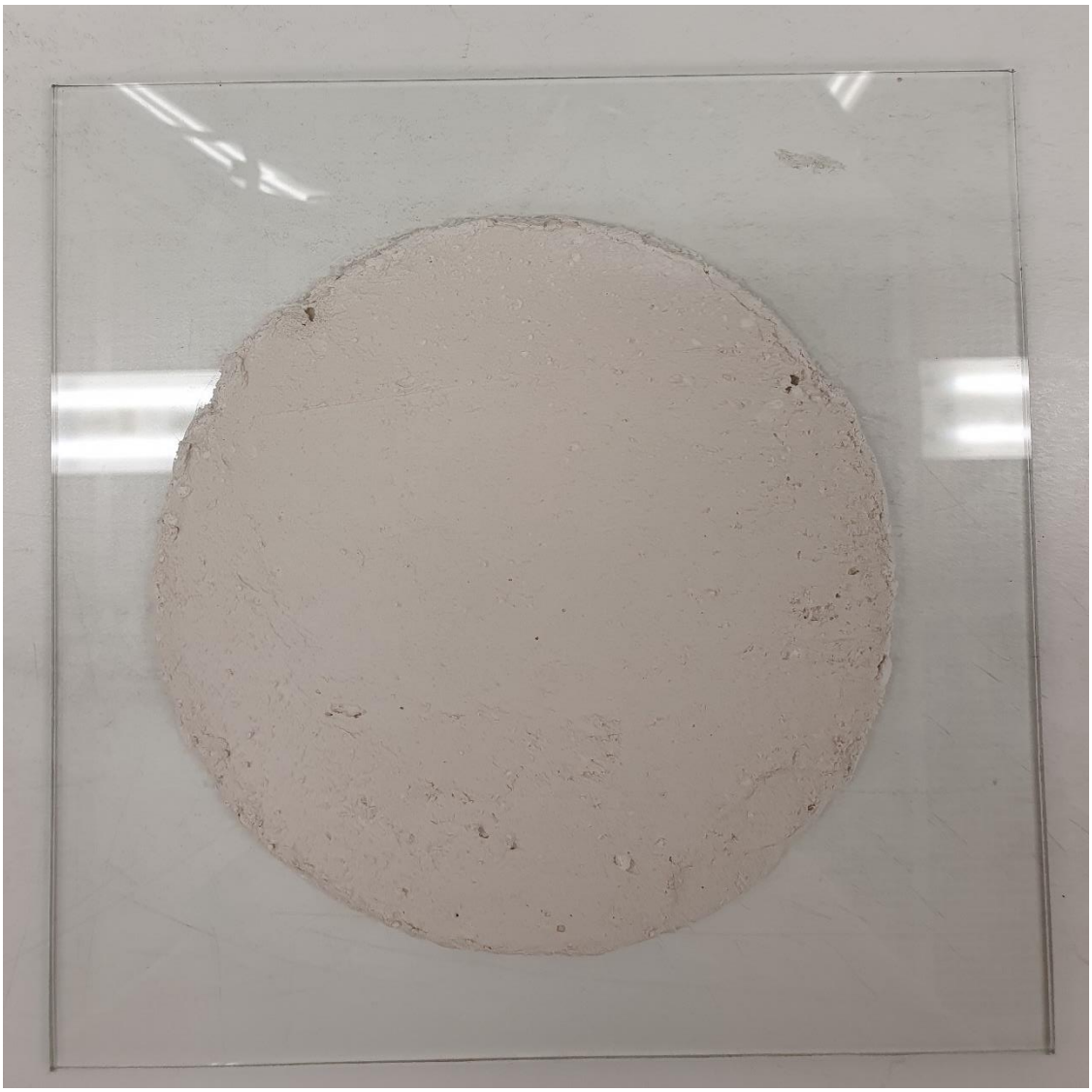
Appendix 2

Photo of the test specimen



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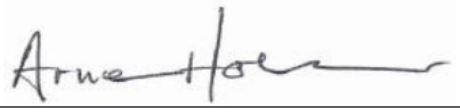
Appendix 3

Sampling Report

Sampler (Name, Company, contact info): Arne Holm Täby Brandskyddsteknik AB arne.holm@tbt.se	**Manufacturer of the product** (Company, address): Täby Brandskyddsteknik AB Okvistavägen 13 186 40 Vallentuna Tel: 08-7921601
Name of product: TBT Firestop compo	**Type of product:** Gypsum fire protection compound
Manufacturing Date: 2022-02-15	**Batch No:** 2022-02-15
Date of sampling: 2022-03-03	**Amount/size of material sampled:** 8 liter **Packing material:** Plastic bucket
Sample is taken from: Production line ☐ Stock / Storage x Miscellaneous ☐ -where, specify:	**How was the product stored before sampling?** In a standard paper sack
If a sub-sample was collected from a larger material amount, describe how the sub-sample was taken:	
Observations and remarks:	
Confirmation I hereby confirm that the sample was selected, taken and packed in accordance with the instructions.	
Date: 2022-03-03	**Signature:** 

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Verification

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