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Determination of VOC, SVOC and VVOC emissions from building products – AgBB requirements

Process: LQAI.MC.26/26
Report Nr. LQAI.2026.258

Identification of the Material: ECObloco
Client: Cânhamor, Lda.

U.PORTO

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The results presented refer only to the item tested.
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0. DOCUMENTAL CONTROL

0.1 IDENTIFICATION OF DOCUMENT

Projet	---
Name of Document	Determination of VOC, SVOC and VVOC emissions from building products - AgBB requirements
Name of file	---

0.2 CONTROL OF VERSIONS

Version	Edition	Revision	Date	Description	Approved by
1	1	0	19/05/2026	Original version	SM

0.3 AUTHOR(S)

Name	Entity	Initials
Susana Martins / Responsável Técnico do Laboratório	INEGI	SM

0.4 REVISER(S)

Name	Entity	Initials

0.5 LIST OF DISTRIBUTION

Name	Entity	Initials
Laboratório Qualidade Ar Interior	INEGI	LQAI
---	Cânhamor, Lda.	

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1. OBJECTIVE

Determination of emissions of Volatile Organic Compounds (VOC), Semi Volatile Organic Compounds (SVOC) and Very Volatile Organic Compounds (VVOC) from a sample of material in order to obtain the material classification under the criteria established by AgBB - Evaluation procedure for VOC emissions from building products – 2024.

2. CLIENT

Cânhamor, Lda.

Sitio Recinto da Feira, Edif. Cânhamor s/nº

7670-132 Garvão, Ourique

Reference of Proposal: PE30260265 by 02/03/2026

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3. SAMPLE IDENTIFICATION

Sample name: ECObloco (590mmx285mmx320mm)

Product type: block

Production date: ---

Batch no.: ---

Sampling: client

Sampling date: ---

Packing material: aluminium foil + cling film

number of packages: 5

Sample reception at LQAI: 24/03/2026

For more information see Annex A: Sampling report completed by the client.

4. METHODOLOGIES USED

The selection of the product sample was the sole responsibility of the client. Results apply to sample as received. The tests and analysis presented were carried out in the permanent facilities of the laboratory.

The sample was prepared according ISO 16000-11[1], in the facilities of the laboratory on 30/03/2026 (picture of sample in annex B). Note that sample preparation is outside the scope of laboratory accreditation.

The test in the test chamber started on 30/03/2026 and was performed in accordance with EN16516[2] and ISO16000-9[3]. This test is accredited in accordance with EN ISO/IEC 17025[4]:

Test	**Method**
Sampling of Volatile Organic Compounds in tenax tubes from building products and furnishing. Emission teste chamber method.	EN 16516:2017+A1:2020 ISO 16000-9:2024

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It should be noted that the remaining compounds determined in this test and are out the scope of accreditation, are determined using the same quality standards that apply to them.

A chamber made of stainless steel was used to carry out the test. A multi-step air clean-up is performed (the air passes through several filters) before loading the chamber. According to EN16516[2], before starting the test, a blank check of the empty chamber is performed. The results obtained are shown in Table 1. The recovery rates in the climate test chamber have been determined using toluene and n-dodecane. The mean recovery rates of toluene and n-dodecane were concluded to be between 86% and 100%, depending on the compound and the volume of the test chamber. These values comply with the criteria of a minimum mean recovery rate of 80% stated in the test method (ISO 16000-9[3]).

The experimental conditions in the chamber, during the conditioning period and during the test period, were as follows:

Parameter	Value
Chamber volume (L)	0.141
Air change rate (h^{-1})	0.32
Air Velocity (m/s)	0.15
Area specific ventilation rate, qe ($m^3h^{-1}m^{-2}$)	0.54
Relative humidity (%)	50.5 ± 1.2
Temperature (°C)	22.4 ± 0.7
Sample area (m^2)	0.083
Loading factor (m^2/m^3)	0.59
Loading scenario	wall

Temperature and relative humidity were measured using a Testo thermohygrometer, model Saveris 2H1, and velocity was measured using a Testo anemometer, model 0635 1049. Flow rates were measured using flowmeters from Mesa Labs (model Defender 510-M) and Gilian (model Gilbrator 2).

The VOCs and SVOCs were collected, in tubes with Tenax TA and in duplicate 3 days and 28 after starting the test. In these samplings, sampling pumps from Casella, model Apex, and flowmeters from Mesa Labs (model Defender 510-M) and Gilian (model Gilbrator 2).

Formaldehyde, acetaldehyde (and other aldehydes) and acetone were collected in cartridges impregnated with DNPH when the test chamber was empty and 3 and 28 days after starting the test. In these samplings, sampling pumps from SKC, model AirChek XR5000, and flowmeters from Mesa Labs (model Defender 510-M) and Gilian (model Gilbrator 2), were used. This sampling is out the scope of accreditation.

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The sampling data are presented below:

	VOC/SVOC Sampling			Aldehyde Sampling		
	Date	Time* (min.)	Volume* (L)	Date	Time* (min.)	Volume* (L)
Blank	25/03/2026	42	4.95	25/03/2026	120	90.4
3 days	02/04/2026	31	3.51	---	---	---
28 days	27/04/2026	61	6.02	27/04/2026	120	66.5

*The sampling time and sampling volume values presented refer to average values.

For the analysis, thermal desorption on line with gas chromatography coupled to a mass spectrometer detector for VOC/SVOC identification and quantification (GC/MSD) was used. The GC used is from Agilent Technologies, model 7890A and the mass spectrometer detector is from Agilent also, model 5975C. The thermal desorption system is from Perkin Elmer, model Turbo Matrix 650. The analysis was conducted on 06/05/2026 and was performed in accordance to EN16516[2] and ISO16000-6[5]. This test is accredited in accordance with EN ISO/IEC 17025[4] for the compounds:

Test	**Method**
Determination of Benzene by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of Toluene by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of Octane by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of Ethylbenzene by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of 2-Ethoxyethylacetate by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of 1,2,4-trimethylbenzene by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of 2-ethyl-1-hexanol by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of limonene by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of dodecane by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of 2-phenoyethanol by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of tridecane by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of styrene by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of tetrachloroethylene by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of 2-butoxyethanol by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of naphthalene by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of n-butyl acetate by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021

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Determination of phenol by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of hexadecane by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of hexane by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of methyl isobutyl ketone by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021
Determination of o-xylene by thermal desorption and Gas chromatography with mass selective detector	EN 16516:2017+A1:2020 ISO 16000-6:2021

It should be noted that the remaining compounds determined in this test which are not covered by the accreditation are determined using the same quality standards as applied to them.

The emission factors of the identified compounds were determined using the specific response factor, when possible. Total volatile organic compounds (TVOC) concentration was calculated for all compounds with concentration higher than 5 $\mu g/m^3$, eluted between hexane and hexadecane, using the specific response factor for the identified compounds, and the toluene response factor in the remaining cases. Total semi volatile organic compounds (COSVT) concentration was calculated as the sum of the emission factors of all compounds with retention times between hexadecane and docosane, with concentrations greater than 5 $\mu g/m^3$, using the toluene response factor.

The expanded uncertainties obtained for the different methods are presented below.

Analysis Method, according to the standards: EN 16516:2017+A1:2020 ISO 16000-6:2021	Sampling Method, according to the standards: EN 16516:2017+A1:2020 ISO 16000-9:2024	Global Method (analysis + sampling), according to standards: EN 16516:2017+A1:2020 ISO 16000-6:2021 ISO 16000-9:2024
31%	26%	38%

Note: Uncertainties were calculated individually for each compound, whenever possible, and the highest value obtained for each method is presented.

The expanded uncertainty was calculated using the expansion factor of 2.01, corresponding to a 95% confidence level.

Formaldehyde, acetaldehyde and acetone were determined according to ISO 16000-3[6]. Specifically, the compounds were analysed by high performance liquid chromatography (HPLC) using a chromatograph Agilent Technologies brand, model 1220 Infinity LC. The emission factor of the compounds was calculated based on the specific response factor of the analytical method. The analysis took place on 26/03/2026 and 07/05/2026. The uncertainty of the analytical method is ±8.4% for formaldehyde and ±8.6% for acetaldehyde. This analysis is out the scope of accreditation.

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5. RESULTS

Table 1 shows the background chamber concentrations of target compounds.

Table 1. Background chamber concentrations of target compounds

Compound	CAS	Concentration (µg/m³)
Formaldehyde[++]	50-00-0	< 4*
Acetaldehyde[++]	75-07-0	< 5*
Acetic acid[++]	64-19-7	< 2*[T]
2-Butanone[+]	78-9-3	< 2*[T]
Propanenitrile, 2,2'-azobis[2-methyl- [+]	78-67-1	< 2*[T]
2-Ethyl-1-hexanol	104-76-7	< 2*[T]
Limonene	138-86-3	< 2*[T]
2-Ethylhexyl acetate[+]	103-09-3	< 2*[T]
2-Ethylhexyl acrylate[+]	103-11-7	< 2*[T]
TVOC[+]	---	< 20[T]

* Limit of quantification
[T] Concentration in toluene equivalents
[++] Out of the scope of accreditation.
[+] Parameter out of the scope of accreditation for analysis by thermal desorption and gas chromatography with mass selective detector (EN 16516:2017+A1:2020 and ISO 16000-6:2021). Only sampling in tenax tubes - emission teste chamber method (EN 16516:2017+A1:2020 and ISO 16000-9:2024) is within the scope of accreditation.

Table 2 show the emission factor for TVOC, TSVOC and individual compounds quantified as well as the results of the application of the criteria defined by AgBB (2024)[7]and LEED V4.1[8], considering the specific ventilation rate (qe) of 0.5 $m^3\ h^{-1}m^{-2}$ (test scenario: walls).

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Table 2. Results obtained for the compounds quantified in the emission test and application of AgBB and LEED v4.1 criteria.

Compound	CAS	LCI (µg/m³)	Emission Factor (µg/(m²h)) 3 days	28 days
Acetic acid⁺⁺ b)	64-19-7	1200	22	37
2-Butanone⁺	78-9-3	20000	49	14
Propanenitrile, 2,2'-azobis[2-methyl- ⁺	78-67-1	---	7	a)
2-Ethyl-1-hexanol	104-76-7	300	82	30
Limonene	138-86-3	5000	12	a)
2-Ethylhexyl acetate⁺	103-09-3	350	11	a)
2-Ethylhexyl acrylate⁺	103-11-7	380	7	a)
formaldehyde⁺⁺	50-00-0	100	---	a)
acetaldehyde⁺⁺	75-07-0	300	---	76
acetone⁺⁺	67-64-1	120000	---	a)
TVOC⁺	---	---	190	82
TSVOC⁺	---	---	a)	a)

Parameter to be assessed (AgBB)	Condition to be fulfilled	Results
3 days		
VOCs Carcinogenic 1A and 1B*⁺ (µg/m³)	< 10	< L.Q.*ᵀ
TVOC⁺ (µg/m³)	< 10000	380
28 days		
TVOC⁺ (µg/m³)	< 1000	160
TSVOC⁺⁺ (µg/m³)	<100	<5
VOCs Carcinogenic 1A and 1B§⁺ (µg/m³)	< 1	< L.Q.*ᵀ
formaldehyde⁺⁺ (µg/m³)	< 100	<5
acetaldehyde⁺⁺ (µg/m³)	< 300	150
R = Σ (Ci/LCIi)	< 1	0.71
Σ Cn (µg/m³)	< 100	< 5
EVALUATION		**Positive**

Parameter to be assessed (LEED v4.1)	Condition to be fulfilled	Results
28 days		
formaldehyde⁺⁺ (µg/m³)	< 10	< 4*

a) Compound with concentration less than 5 µg/m³. Only substances with concentrations equal to or greater than 5 µg/m³ should be quantified.

b) Acetic acid is reported for information only and is not included in TVOC or R-value calculations (EN 16516 / AgBB).

⁺⁺ Out of the scope of accreditation.

⁺ Parameter out of the scope of accreditation for analysis by thermal desorption and gas chromatography with mass selective detector (EN 16516:2017+A1:2020 and ISO 16000-6:2021). Only sampling in tenax tubes - emission teste chamber method (EN 16516:2017+A1:2020 and ISO 16000-9:2024) is within the scope of accreditation.

§ Carcinogenic substances according with Regulation (EC) No 1272/2008.

* Limit of quantification

*ᵀ L.Q. - Limit of Quantification. L.Q. in toluene equivalents = 0.00095 mg/m³.

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LCI – Lowest concentration of interest (AgBB 2024[7]); R - Index summarising the estimated health risk of a material emission (only listed substances whose concentrations in the test chamber air exceed 5 mg/m^3 are evaluated based on LCI): R=∑ (Ci/LCIi);
Ci – concentration of an individual compound for which a LCI value is know: Ci = FE / qe;
Σ (Cn) - Sum of the concentrations of the compounds, after 28 days of exposure, non-identified or for which a LCI value is not known: Cn = FE / qe,

6. GENERAL CONCLUSIONS

By customer request, the results obtained are compared with the criteria established AgBB[7]. The decision rule chosen is that uncertainty is not applied to the final result. In other words, the result obtained is directly compared with the established criteria, without considering the uncertainty associated with this result.

The results presented in Table 2 show that, under the criteria set by AgBB and LEED V4.1, the material "ECObloco" has a positive evaluation.

7. REFERENCES

1- ISO 16000-11 (2024). Determination of the emission of volatile organic compounds from building products and furnishing — Sampling, storage of samples and preparation of test specimens.
2- - EN 16516:2017 + A1:2020: Construction products: Assessment of release of dangerous substances - Determination of emissions into indoor air
3- - ISO 16000-9 (2024): Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method.
4- NP EN ISO/IEC 17025 – Requisitos gerais de competência para laboratórios de ensaio e calibração.
5- ISO 16000-6 (2021): 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.
6- ISO 16000-3 (2022). Determination of formaldehyde and other carbonyl compounds - Active sampling method
7- AgBB evaluation procedure for VOC emissions from building products (2024).
8- LEED v4.1 – Interior Design and Construction. Getting started guide for beta participants (April 2023).

Porto, 19 May 2026

Susana Martins

Digitally signed by Susana Daniela da Silva Martins
Date: 2026.05.19 12:29:38 +01'00'

(Head of Laboratory)

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Annex A: Sampling report completed by the client.

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Testing laboratory / certification body:	INEGI	Sampler (name , company, telephone):	Pedro Zilhão Cânhamor Lda. 961873675
Name of the manufacturer at the place of sampling (address/stamp):		Manufacturer (if deviating from company´s name at the place of sampling):	Cânhamor Lda
Name of the product:	ECObloco	Type of product (e.g. paint, laminate, textile flooring, PVC-flooring).	Bloco de alvenaria
Model/program/series:		Batch nº:	
Article Nº:		Date of batch production:	
Sample is taken from:	[X] Production [ ] Store [ ] Retain samples [ ] Miscellaneous	How had the product been stored prior to sampling?	[X] Open [ ] Wrapped up
	Place of storage: debaixo de um telheiro		Packing material:

Sample Description/ Application *mention where applicable:* Density % Solids by volume Spread rate Application type (e.g. walls, floor, doors, sealants)	É indicado para utilizar na execução das paredes. Espessuras menores são usadas como revestimento (interno ou externo) de paredes pré existentes. Pode também ser usado como isolamento de pavimento e coberturas.
Specifics (Possible negative influences by emission at the place of taking the sample, petrol emissions, solvent emissions from production, uncertainties, questions, etc.):	
Cut edges (identification of cut edges when present and identification of new surfaces and surface to be exposed in the emission test):	

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Laboratório da Qualidade do Ar Interior	Report of the Sampling Procedure

Confirmation The signer herewith confirms the correctness of the data given above. The sample was selected, drawn and packed personally in accordance with the instructions for the taking of samples.	
Date	Signature (stamp)

Please attach the Technical Data Sheet of the product.

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Annex B: Photo of the sample of the material under study

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Campus da FEUP | Rua Dr. Roberto Frias, 400 | 4200-465 Porto | PORTUGAL
T. +351 22 957 87 10 | F. +351 22 953 73 52 | inegi@inegi.up.pt

www.inegi.up.pt