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Determination of VOC, SVOC and formaldehyde, emissions from building products - BREEAM Criteria

Process: LQAI.MC.26/26
Report No. LQAI.2026.259

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

U.PORTO

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0. DOCUMENTAL CONTROL

0.1 IDENTIFICATION OF DOCUMENT

Projet	---
Name of Document	Determination of VOC, SVOC and formaldehyde emissions from building products - BREEAM Criteria
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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TABLE OF CONTENTS

1. SAMPLE IDENTIFICATION 6
2. OBJECTIVE 5
3. CLIENT 5
4. METHODOLOGIES USED 6
5. RESULTS 10
6. GENERAL CONCLUSIONS 11
7. REFERENCES 11

1. OBJECTIVE

Determination of emitted volatile organic compounds (VOC), semi volatile organic compounds (SVOC) and formaldehyde intending the material classification according to the criteria established by BREEAM.

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

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 (ºC)	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 a Gilian primary flowmeter, model Gilbrator 2. Flow rates were measured using primary flow meters from Mesa Labs (model Defender 510-M) and Gilian (model Gilbrator 2).

The VOCs were collected, in tubes with Tenax TA, when the test chamber was empty and were collected in duplicate 28 after starting the test. In these samplings, sampling pumps from Casella, model Apex, and primary flow meters from Mesa Labs (model Defender 510-M) and Gilian (model Gilbrator 2), were used.

Formaldehyde were collected in cartridges impregnated with DNPH when the test chamber was empty and 28 days after starting the test. In these samplings, sampling pumps from SKC, model AirChek XR5000, and primary flow meters from Mesa Labs (model Defender 510-M) and Gilian (model Gilbrator 2), were used. These sampling is outside the scope of laboratory accreditation.

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The sampling data are presented below:

	VOC 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
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 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 Matrix 650. The analysis was conducted on 06/05/2026 and was performed in accordance to EN 16516[2] and ISO 16000-6[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

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. Total volatile organic compounds (TVOC) concentration was calculated for all compounds eluted between hexane and hexadecane, with concentrations greater than 5 $\mu g/m^3$, using the toluene response factor. 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
30%	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 was determined according to ISO 16000-3[6]. Specifically, the compounds were analysed by high performance liquid chromatography (HPLC) using a gas 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 for formaldehyde is ±8.4% and for acetaldehyde is ±8.6%. 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*
Individual VOC⁺	---	< 2*ᵀ
TVOC⁺	---	< 20ᵀ

* 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 shows the concentrations of the substances or groups of substances, considering the specific ventilation rate (qe) of 0.5 $m^3h^{-1}m^{-2}$ (test scenario: walls), as well as the concentration limits established by BREEAM[7].

Table 2. Limits established by BREEAM and concentrations of compounds observed in the material after 28 days of exposure, with a specific ventilation rate of 0.5 $m^3h^{-1}m^{-2}$.

Parameter to be evaluated	Results	BREEAM Emission Criteria	BREEAM Exemplary Level Emission Criteria
TVOC⁺ (mg/m³) ⁺	0.040	< 1.0 ✓	< 0.3 ✓
VOCs Carcinogenic 1A and 1B§⁺ (mg/m³)	< L.Q.*	< 0.001 ✓	< 0.001 ✓
formaldehyde⁺⁺ (mg/m³)	< 0.004**	< 0.06 ✓	< 0.01 ✓
TSVOC⁺ (mg/m³)	< 0.005	---	< 0.1 ✓
EVALUATION		**Positive**	**Positive**

+ 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.
⁺⁺ Out of the scope of accreditation.
§ Carcinogenic substances according with Regulation (EC) No 1272/2008.
* L.Q. - Limit of Quantification. L.Q. in toluene equivalents = 0.00095 mg/m³.
** Limit of Quantification.

6. GENERAL CONCLUSIONS

By customer request, the results obtained are compared with the criteria established by BREEAM[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 shows that the material "ECObloco" meets the criteria established by BREEAM, fully complying with the Exemplary Level Emission Criteria.

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- BREEAM International New Construction - Technical Manual – Version 6.0.0 – 01/12/2021 – SD250.

Porto, 19 May 2026

Susana Martins

Digitally signed by Susana Daniela da Silva Martins
Date: 2026.05.19 12:27:50 +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):	

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