

IEdiSA, SA  
Polg Ind Poliviso.  
C/Herrerros, 8, 41520  
EL VISO DEL ALCOR, Sevilla  
Spain

## Test Report No. 50457-001 (II)

VOC decree France

<b>Client:</b>	<b>IEdiSA, SA</b>
<b>Sample description by client:</b>	<b>Graphenstone Pintura Interior</b>
Sampling by:	Client
Date of arrival of sample:	15.07.2015
Date of report:	09.09.2015
Number of pages of report:	13
Testing parameter:	see table of contents
Testing laboratory:	eco-INSTITUT Germany GmbH, Cologne

## Content

Test Report .....	3
1 Emission test .....	3
1.1 Volatile Organic Compounds (VOC) .....	3
Measurement time 28 days after test chamber loading .....	7
1.1.1 VOC / TVOC <sub>28d</sub> .....	7
1.1.1.1 Formaldehyde <sub>28d</sub> and Acetaldehyde <sub>28d</sub> .....	8
2 Phthalates, chamber air analytics .....	9
3 Expert evaluations .....	10
3.1 Expert evaluation (French VOC- / CMR-regulation).....	10
3.1.1 Summary evaluation .....	11
3.2 Evaluation d'expert (COV décret / CMR arrêté).....	12
3.2.1 Résumé d'évaluation .....	13

## Sample view

Internal Sample-no.	Description by customer	Condition upon delivery	Type of sample
A001	Graphenstone Pintura Interior	without objection	material sample

# Test Report

## 1 Emission test

### 1.1 Volatile Organic Compounds (VOC)

#### Definition of terms:

VOC (volatile organic compounds)	All individual materials with a concentration $\geq 0,001 \text{ mg/m}^3$ in retention range $C_6$ (n-Hexane) to $C_{16}$ (n-Hexadecane) Substances refer to LCI lists / AgBB (DIBt)
TVOC (Total volatile organic compounds)	Sum of all individual substances in retention range $C_6$ to $C_{16}$ .
CMR-VOC (carcinogenic, mutagenic, reproduction-toxic VOC, VVOC and SVOC)	All individual substances with the following categories: Regulation (EC) No. 1272/2008: Category Car.1A and 1B, Muta. 1A and 1B, Repr. 1A and 1B TRGS 905: K1 and K2, M1 and M2, R1 and R2 IARC: Group 1 and 2A DFG (MAK lists): Category III1 and III2
VVOC (very volatile organic compounds)	All individual substances with concentration $\geq 0,001 \text{ mg/m}^3$ in retention range $< C_6$
TVVOC (Total very volatile organic compounds)	Sum of all VVOC in retention range $< C_6$
SVOC (semi volatile organic compounds)	All individual materials $\geq 0,001 \text{ mg/m}^3$ in retention range $> C_{16}$ (n-Hexadecane) to $C_{22}$ (Docosane)
TSVOC (Total semi volatile organic compounds)	Sum of all SVOC in retention range $> C_{16}$ to $C_{22}$ .
Identified and calibrated substances ( $C_{id \text{ sub}}$ ), substance specific calculated	Spectrum and retention time are concordant with the calibrated comparison substance
Not identified substances calculated as toluene equivalent ( $C_{ni \text{ tol}}$ )	Suggestion from the spectrum library with high probability and/or allocation to a group of substances
SER	Specific emission rate (see appendix)
LCI value	Lowest Concentration of Interest; calculated value for the evaluation of VOC, established by the Committee for Health-related Evaluation of Building Products (Ausschuss zur gesundheitlichen Bewertung von Bauprodukten - AgBB)
R value	The quotient of the concentration and the LCI value is generated for every substance which is detected in the test chamber air. The sum of the calculated quotients results in the R value.

## List of analysed VOCs:

### Aromatic hydrocarbons

Toluene  
Ethylbenzene  
p-Xylene  
m-Xylene  
o-Xylene  
Isopropylbenzene  
n-Propylbenzene  
1,3,5-Trimethylbenzene  
1,2,4-Trimethylbenzene  
1,2,3-Trimethylbenzene  
2-Ethyltoluene  
1-Isopropyl-4-methylbenzene  
1,2,4,5-Tetramethylbenzene  
n-Butylbenzene  
1,3-Diisopropylbenzene  
1,4-Diisopropylbenzene  
Phenyl octane  
1-Phenyl decane<sup>2</sup>  
1-Phenyl undecane<sup>2</sup>  
4-Phenylcyclohexene  
Styrene  
Phenyl acetylene  
2-Phenyl propene  
Vinyl toluene  
Naphthalene  
Indene  
Benzene  
Cresol

### Saturated aliphatic substances

Hydrocarbons  
2-Methyl pentane<sup>1</sup>  
3-Methyl pentane<sup>1</sup>  
n-Hexane  
Cyclohexane  
Methylcyclohexane  
n-Heptane  
n-Octane  
n-Nonane  
n-Decane  
n-Undecane  
n-Dodecane  
n-Tridecane  
n-Tetradecane  
n-Pentadecane  
n-Hexadecane  
Methylcyclopentane  
1,4-Dimethylcyclohexane

### Terpenes

δ-3-Carene  
α-Pinene  
β-Pinene  
Limonene  
Longifolene  
Caryophyllene  
Isolongifolene  
alpha-Phellandrene  
Myrcene  
Camphene  
alpha-Terpinene  
Longipinene  
beta-Caryophyllene  
beta-Farnesene  
alpha-Bisabolene

### Aliphatic alcohols and ether

1-Propanol<sup>1</sup>  
2-Propanol<sup>1</sup>  
tert-Butanol  
2-Methyl-1-propanol

1-Butanol  
1-Pentanol  
1-Hexanol  
Cyclohexanol  
2-Ethyl-1-hexanol  
1-Octanol  
4-Hydroxy-4-methyl-pentan-2-one  
1-Heptanol  
1-Nonanol  
1-Decanol

### Aromatic alcohols (phenols)

Phenol  
BHT (2,6-di-tert-butyl-4-methylphenol)  
Benzylalcohol

### Glycols, Glycol ether, Glycol ester

Propylenglycol (1,2-Dihydroxypropane)  
Ethylene glycol (Ethandiol)  
Ethylene glycol monobutyl ether  
Diethylene glycol  
Diethylene glycol-monobutyl ether  
2-Phenoxyethanol  
Ethylene carbonate  
1-Methoxy-2-propanol  
Glycolic acid butyl ester  
Texanol  
Butyldiglycol acetate  
Dipropylenglycol mono-methyl ether  
2-Methoxyethanol  
2-Ethoxyethanol  
2-Propoxyethanol  
2-Methylethoxyethanol  
2-Hexoxyethanol  
1,2-Dimethoxyethane  
1,2-Diethoxyethane  
2-Methoxyethyl acetate  
2-Ethoxyethyl acetate  
2-Butoxyethyl acetate  
2-(2-Hexoxyethoxy)-ethanol  
1-Methoxy-2-(2-methoxy-ethoxy)-ethane  
Propylene glycol di-acetate  
Dipropylene glycol  
Dipropylene glycol monomethylether acetate  
Dipropylene glycol mono-n-propylether  
1,4-Butanediol  
Tripropyleneglycolmonomethyl ether  
Triethylene glycol dimethyl ether  
1,2-Propylene glycol dimethyl ether  
TXIB  
Ethylidiglycol  
Dipropylene glycol-dimethyl ether  
Propylene carbonate  
Hexylene glycol  
3-Methyl-1-butanol  
1,2-Propylene glycol n-propyl ether  
1,2-Propylene glycol n-butyl ether  
Diethylglycol phenyl ether  
Neopentyl glycol

### Aldehydes

Butanal<sup>1,3</sup>  
Pentanal<sup>3</sup>  
Hexanal  
Heptanal  
2-Ethylhexanal  
Octanal  
Nonanal  
Decanal  
2-Butenal<sup>3</sup>

2-Pentenal<sup>3</sup>  
2-Hexenal  
2-Heptenal  
2-Octenal  
2-Nonenal  
2-Decenal  
2-Undecenal  
Furfural  
Glutaraldehyde  
Benzaldehyde  
Acetaldehyde<sup>1,3</sup>  
Propanal<sup>1,3</sup>  
Propenal<sup>1,3</sup>  
Isobutenal  
3-Methyl-2-propanol  
Methylisobutylketone  
Cyclopentanone  
Cyclohexanone

### Ketones

Ethylmethylketone<sup>3</sup>  
3-Methyl-2-propanol  
Methylisobutylketone  
Cyclopentanone  
Cyclohexanone  
Acetone<sup>1,3</sup>  
2-Methylcyclopentanone  
2-Methylcyclohexanone  
Acetophenone  
1-Hydroxyacetone

### Acids

Acetic acid  
Propionic acid  
Isobutyric acid  
Butyric acid  
Pivalic acid  
n-Valeric acid  
n-Hexanoic acid  
n-Heptanoic acid  
n-Octanoic acid  
2-Ethylhexanoic acid

### Esters and Lactones

Methylacetate<sup>1</sup>  
Ethyl acetate<sup>1</sup>  
Vinyl acetate<sup>1</sup>  
Isopropyl acetate  
Propyl acetate  
2-Methoxy-1-methylethyl acetate  
n-Butyl formate  
Methylmethacrylate  
Isobutylacetate  
1-Butyl acetate  
2-Ethylhexyl acetate  
Methyl acrylate  
Ethyl acrylate  
n-Butyl acrylate  
2-Ethylhexyl acrylate  
Adipic acid dimethyl ester  
Fumaric acid dibutyl ester  
Succinic acid dimethyl ester  
Hexandioldiacrylate  
Maleic acid dibutyl ester  
Butyrolactone  
Dibutyl glutarate  
Dibutyl succinate  
Dimethylphthalate  
Texanol  
Dipropylene glycol diacrylate

### Chlorinated hydrocarbons

Tetrachlorethene  
1,1,1-Trichlorethane  
Trichlorethene  
1,4-Dichlorbenzene

### Others

1,4-Dioxane  
Caprolactam  
N-Methyl-2-pyrrolidone  
Octamethylcyclotetrasiloxane  
Methenamine  
2-Butanonoxime  
Triethyl phosphate  
5-Chlor-2-methyl-4-isothiazolin-3-one  
2-Methyl-4-isothiazolin-3-one (MIT)  
Triethylamine  
Decamethylcyclopentasiloxane  
Dodecamethylcyclopentasiloxane  
Tetrahydrofuran (THF)  
1-Decene  
1-Octene  
2-Pentylfuran  
Tetramethyl succinonitrile  
Propylencarbonate  
Isophorone  
Dimethylformamide (DMF)  
Tributyl phosphate

1 VVOC  
2 SVOC  
3 Analysis according to  
DIN ISO 16000-3

## Explanation of the Specific Emission Rate SER

Emission measurements are accomplished in test chambers under defined physical conditions (temperature, relative humidity, room loading, air change rate etc.).

Test chamber measurement results are directly comparable only if the investigations were accomplished under the same basic conditions.

If the differences of the physical conditions refer only to the change of air rate and/or the loading, the "SER" or "specific emission rate" can be used for comparability of the measurement results. The SER indicates how many volatile organic compounds (VOC) are released by the sample for each material unit and hour (h). The SER can be calculated using the formula below for each proven individual component of the VOC from the data in the test report.

As material units the following are applicable:

l = unit of length (m)	relation between emission and length
a = unit area (m <sup>2</sup> )	relation between emission and surface
v = unit volume (m <sup>3</sup> )	relation between emission and volume
u = piece unit (unit = piece)	relation between emission and complete unit

From this the different dimensions for SER result:

length-specific	SER <sub>l</sub> in µg/m h
surface-specific	SER <sub>a</sub> in µg/m <sup>2</sup> h
volume-specific	SER <sub>v</sub> in µg/m <sup>3</sup> h
unit specific	SER <sub>u</sub> in µg/u h

SER thus represents a product specific rate, which describes the mass of the volatile organic compound, which is emitted by the product per time unit at a certain time after beginning of the examination.

$$\boxed{SER = q \cdot C}$$

q	specific air flow rate (quotient from change of air rate and loading)
C	Concentration of the measured substance(s)

The result can be indicated in milligrams (mg) in place of micro grams (µg), whereby 1 mg = 1000 µg.

**Test method TS 16516 with following parameters:**

Preparation of test sample:	Date:	06.08.2015
	Pre-treatment:	not applicable
	Masking of backside:	not applicable
	Masking of edges:	not applicable
	Relationship of unmasked edges to surface:	not applicable
	Charging:	related to area
	Dimensions:	2 x ( 25 cm x 25 cm ) ( 10,4 g / application / plate )
Test chamber conditions:	Chamber volume:	0.125 m <sup>3</sup>
	Temperature:	23 °C
	Relative humidity:	50 %
	Air pressure:	normal
	Air:	cleaned
	Air change rate:	0.5 h <sup>-1</sup>
	Air velocity:	0.3 m/s
	Loading:	1 m <sup>2</sup> /m <sup>3</sup>
	Specific air flow rate:	0.5 m <sup>3</sup> /m <sup>2</sup> · h
	Air sampling:	3 and 28 days after test chamber loading
Analytics:	DIN ISO 16000-3	
	Limit of determination:	2 µg/m <sup>3</sup>
	DIN ISO 16000-6	
	Limit of determination:	1 µg/m <sup>3</sup>

## Measurement time 28 days after test chamber loading

### 1.1.1 VOC / TVOC<sub>28d</sub>

**Test parameter:**

Volatile organic compounds (VOC), test chamber, air sampling 28 days after test chamber loading

**Test result:**

Sample: A001: Graphenstone Pintura Interior

No.	Substance	CAS No.	Concentration (Test chamber air) [µg/m <sup>3</sup> ]
<b>VOC<sub>28d</sub>: Identified and calibrated substances in accordance with LCI list/AgBB, substance specific calculated (C<sub>id sub</sub>)</b>			
<b>1</b>	<b>Aromatic hydrocarbons</b>		
1-1	Toluene	108-88-3	n.d.
1-2	Ethylbenzene	100-41-4	n.d.
1-4	p-Xylene	106-42-3	n.d.
1-5	m-Xylene	108-38-3	
1-6	o-Xylene	95-47-6	n.d.
1-11	1,2,4-Trimethylbenzene	95-63-6	n.d.
1-25	Styrene	100-42-5	n.d.
<b>6</b>	<b>Glycols, Glycol ethers, Glycol esters</b>		
6-3	Ethylene glycol monobutyl ether	111-76-2	n.d.
<b>11</b>	<b>Chlorinated hydrocarbons</b>		
11-1	Tetrachlorethene	127-18-4	n.d.
<b>VOC<sub>28d</sub>: Further identified and calibrated substances in addition with LCI list/AgBB, substance specific calculated (C<sub>id sub</sub>)</b>			
<b>1</b>	<b>Aromatic hydrocarbons</b>		
	Benzene	71-43-2	n.d.
<b>11</b>	<b>Chlorinated hydrocarbons</b>		
	1,4-Dichlorbenzene	106-46-7	n.d.

n.d. = not detectable

Total volatile organic compounds (Toluene Equivalent DIN ISO 16000-6)	Concentration (test chamber air) [µg/m <sup>3</sup> ]
TVOC <sub>tol,28d</sub>	15

### 1.1.1.1 Formaldehyde<sub>28d</sub> and Acetaldehyde<sub>28d</sub>

**Test parameter:**

Formaldehyde and Acetaldehyde, test chamber, air sampling 28 days after test chamber loading

**Test method:**

Preparation of test sample: according to DIN EN 717-1  
see Volatile organic compounds

Test chamber conditions: DIN EN 717-1 with the following deviations:

- No determination of the equilibrium concentration; the formaldehyde emission is indicated at a measuring point as determined above.
- Chamber volume: see Volatile organic compounds
- Relative humidity: 50%
- Air change rate and loading: see Volatile organic compounds

Emission chamber parameters: see volatile organic compounds

Air sampling: 28 days after test chamber loading

Analytics: DIN ISO 16000-3

Limit of determination: 2 µg/m<sup>3</sup> ≈ 0,002 ppm

**Test result:**

Sample: A001: Graphenstone Pintura Interior

Substance	Concentration (Test chamber air) [µg/m <sup>3</sup> ]	Concentration (Test chamber air) [ppm]
Formaldehyde	< 2	< 0,002
Acetaldehyde	< 2	-



## 2 Phthalates, chamber air analytics

**Test parameter:**

Phthalates, chamber air analytics

**Test method:**

Analytics: | DIN ISO 16000-6  
Limit of determination: | 1 µg/m<sup>3</sup>


**Test result:**

Sample: A001, Graphenstone Pintura Interior

Substance	Content (Test chamber air) [µg/m <sup>3</sup> ]
Dibutylphthalate (DBP)	n.d.
Diethylhexylphthalate (DEHP)	n.d.

n.d.: not detectable

Cologne, 09.09.2015



Michael Stein, Dipl.-Chem.  
(Deputy Technical Manager)

### 3 Expert evaluations

#### 3.1 Expert evaluation (French VOC- / CMR-regulation)

The product **Graphenstone Pintura Interior** has been tested on behalf of **IEdiSA, SA**.

This evaluation bases on the test criteria of the decree no. 2011-321 of March 23<sup>rd</sup>, 2011 (VOC) and executive decisions of May 28<sup>th</sup>, 2009 and April 30<sup>th</sup>, 2009 (CMR) of the French Ministry of Ecology, Sustainable Development, Transport and Housing.

The results documented in the test report were evaluated as follows:

#### VOC- Decree France

**Sample: A001:** Graphenstone Pintura Interior

Substance	Concentration (Test chamber air) [µg/m <sup>3</sup> ] after 28 days	Class			
		C	B	A	A+
Formaldehyde	< 2	>120	<120	<60	<10
Acetaldehyde	< 2	>400	<400	<300	<200
Toluene	< 1	>600	<600	<450	<300
Tetrachlorethene	< 1	>500	<500	<350	<250
o-/m-/p-Xylene	< 1	>400	<400	<300	<200
1,2,4-Trimethylbenzene	< 1	>2000	<2000	<1500	<1000
1,4-Dichlorbenzene	< 1	>120	<120	<90	<60
Ethylbenzene	< 1	>1500	<1500	<1000	<750
Ethylenglycol-monobutylether	< 1	>2000	<2000	<1500	<1000
Styrene	< 1	>500	<500	<350	<250
<b>TVOC<sub>tol</sub></b>	<b>15</b>	<b>&gt;2000</b>	<b>&lt;2000</b>	<b>&lt;1500</b>	<b>&lt;1000</b>

#### CMR Regulation

Substance	Concentration (Test chamber air) [mg/m <sup>3</sup> ] after 28 days	Limit value [mg/m <sup>3</sup> ] after 28 days
Benzene	< 1	< 1
Trichlorethene	< 1	< 1
Di(2-ethylhexyl)phthalate (DEHP)	< 1	< 1
Dibutylphthalate (DBP)	< 1	< 1

### 3.1.1 Summary evaluation

The product **Graphenstone Pintura Interior** meets the requirements of the **Class A+** of the decree no. 2011-321 of March 23, 2011 and executive decisions of May 28<sup>th</sup>, 2009 and April 30<sup>th</sup>, 2009 (CMR) of the French Ministry of Ecology, Sustainable Development, Transport and Housing.

Cologne, 09.09.2015



Tobias Rüsing, Dipl.-Geol.  
(Project Manager)

### 3.2 Evaluation d'expert (COV décret / CMR arrêté)

Le produit **Graphenstone Pintura Interior** a été testé sous la responsabilité du producteur **IEdiSA SA**.

Cette évaluation est basée sur les critères du décret n° 2011-321 du 23 mars 2011 (COV décret) et arrêté du 28 mai 2009 et 30 avril 2009 (CMR arrêté) par le Ministère de l'écologie, du développement durable, des transports et du logement.

Les résultats documentés dans le rapport du test sont évalués comme suit.

#### COV décret

Analyse des émissions	Concentration (air de la chambre d'essai) [ $\mu\text{g}/\text{m}^3$ ] au bout de 28 jours	Classe			
Substance		C	B	A	A+
Formaldéhyde	< 2	>120	<120	<60	<10
Acétaldéhyde	< 2	>400	<400	<300	<200
Toluène	< 1	>600	<600	<450	<300
Tétrachloréthylène	< 1	>500	<500	<350	<250
Xylène	< 1	>400	<400	<300	<200
1,2,4-Triméthylbenzène	< 1	>2 000	<2 000	<1 500	<1 000
1,4-Dichlorobenzène	< 1	>120	<120	<90	<60
Ethylbenzène	< 1	>1 500	<1 500	<1 000	<750
2-Butoxyéthanol	< 1	>2 000	<2 000	<1 500	<1 000
Styrène	< 1	>500	<500	<350	<250
<b>COV<sub>tot</sub></b>	<b>15</b>	<b>&gt;2 000</b>	<b>&lt;2 000</b>	<b>&lt;1 500</b>	<b>&lt;1 000</b>

#### CMR arrêté

Analyse des émissions	Concentration (air de la chambre d'essai) [ $\mu\text{g}/\text{m}^3$ ] après 28 jours	Valeur limite [ $\mu\text{g}/\text{m}^3$ ] après 28 jours
Substances		
Benzène	< 1	< 1
Trichloréthylène	< 1	< 1
Phthalate de bis (2-éthylhexle) (DEHP)	< 1	< 1
Phthalat de dibutyle	< 1	< 1

### 3.2.1 Résumé d'évaluation

Le produit **Graphenstone Pintura Interior** correspond aux exigences de la **classification A+** sur les critères du décret n° 2011-321 du 23 mars 2011 (COV décret) et arrêté du 28 mai 2009 et 30 avril 2009 (CMR arrêté) par le Ministère de l'écologie, du développement durable, des transports et du logement.

Cologne, 09.09.2015



Tobias Rüsing, Dipl.-Geol.  
(Chef de projet)