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EL VISO DEL ALCOR, Sevilla  
Spain

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

M1

<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:	18
Testing parameter:	see table of contents
Testing laboratory:	eco-INSTITUT Germany GmbH, Cologne

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## 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-Caren  
α-Pinene  
β-Pinene  
Limonene  
Longifolene  
Caryophyllene  
Isolongifolene  
alpha-Phellandrene  
Myrcene  
Camphene  
alpha-Terpinend  
Longipinene  
beta-Caryophyllene  
beta-Farnesen  
alpha-Bisabolon

**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>  
Isobutanol  
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 CMR-VOC<sub>28d</sub>

**Test parameter:**

Carcinogenic, mutagenic and reproduction-toxic volatile organic compounds (CMR 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> ]	CMR classification*)
<b>VOC<sub>28d</sub>: Identified and calibrated substances in accordance with LCI list/AgBB, substance specific calculated (C<sub>id sub</sub>)</b>				
-	-	-	n.d.	-

<b>VOC<sub>28d</sub>: Further identified and calibrated CMR substances in addition to LCI list/AgBB, substance specific calculated(C<sub>id sub</sub>)</b>				
-	-	-	n.d.	-

<b>VOC<sub>28d</sub>: Further identified, not calibrated CMR substances, calculated as toluene equivalent (c<sub>ni tol</sub>)</b>				
-	-	-	n.d.	-

\*) Classification acc. to Regulation (EC) No. 1272/2008: Category Carc. 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 list): Category III1 and III2

	Concentration (Test chamber air) [µg/m <sup>3</sup> ]	SER <sub>a</sub> [µg/m <sup>2</sup> h]
<b>Sum of VOC</b> with the following categorisations: Regulation (EC) No. 1272/2008: Category Carc. 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 list): Category III1 and III2	n.d.	n.d.

n.d. = not detectable

### 1.1.2 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>6</b>	<b>Glycols, Glycol ethers, Glycol esters</b>		
6-31	Dipropylene glycol mono-n-butyl ether	29911-28-2	1
<b>7</b>	<b>Aldehydes</b>		
7-19	Benzaldehyde	100-52-7	4
<b>10</b>	<b>Esters and Lactones</b>		
10-25	Dibutyl glutarate	71195-64-7	1

<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>12</b>	<b>Others</b>		
	Hexamethylcyclotrisiloxane	541-05-9	4

<b>VOC<sub>28d</sub>: Not calibrated substances calculated as toluene equivalent (c<sub>ni tol</sub>)</b>			
	-	-	n.d.



Total volatile organic compounds	Concentration (test chamber air) [µg/m <sup>3</sup> ]	SER <sub>a</sub> [µg/m <sup>2</sup> h]
TVOC <sub>28d</sub>	10	5
TVOC <sub>28d</sub> , substances ≥ 5 µg/m <sup>3</sup>	n.d.	n.d.

Further VOC sums	Concentration (test chamber air) [µg/m <sup>3</sup> ]	SER <sub>a</sub> [µg/m <sup>2</sup> h]
Sum VOC without LCI	4	2
Sum of bicyclic terpenes	n.d.	n.d.
Sum of sensitising materials with the following categorisations: DFG (MAK lists): Category IV German Federal Institute for Risk Assessment lists: Cat A TRGS 907	n.d.	n.d.
Sum of VOC with the following categorisations: Regulation (EC) No. 1272/2008: Category Carc. 2, Muta. 2, Repr. 2 TRGS 905: K3, M3, R3 IARC: Group 2B DFG (MAK list): Category III3	n.d.	n.d.
C <sub>9</sub> - C <sub>14</sub> - Alkanes / Isoalkanes	n.d.	n.d.
Sum C <sub>4</sub> -C <sub>11</sub> Aldehydes, acyclic, aliphatic	n.d.	n.d.
Sum C <sub>9</sub> -C <sub>15</sub> Alkyl benzenes	n.d.	n.d.
Sum Cresols	n.d.	n.d.

R-Value (without dimension) <sub>28d</sub>	0,06
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n.d. = not detectable

### 1.1.3 SVOC<sub>28d</sub>

**Test parameter:**

Semivolatile organic compounds (SVOC), 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>SVOC<sub>28d</sub>: Identified and calibrated substances in accordance with LCI list/AgBB, substance specific calculated(C<sub>id sub</sub>)</b>			
-	-	-	n.d.

<b>SVOC<sub>28d</sub>: Further identified and calibrated substances in addition to LCI list/AgBB, substance specific calculated(C<sub>id sub</sub>)</b>			
-	-	-	n.d.

<b>SVOC<sub>28d</sub>: Not calibrated substances calculated as toluene equivalent (c<sub>ni tol</sub>)</b>			
-	-	-	n.d.

Total semivolatile organic compounds	Concentration (test chamber air) [µg/m <sup>3</sup> ]	SER <sub>a</sub> [µg/m <sup>2</sup> h]
<b>TSVOC<sub>28d</sub></b>	n.d.	n.d.
<b>TSVOC<sub>28d</sub>, substances ≥ 5 µg/m<sup>3</sup></b>	n.d.	n.d.

n.d. = not detectable

### 1.1.4 **VVOC<sub>28d</sub>**

**Test Parameter:**

Very volatile organic compounds (VVOC), 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>VVOC<sub>28d</sub>: Identified and calibrated substances in accordance with LCI list/AgBB, substance specific calculated (C<sub>id sub</sub>)</b>			
-	-	-	n.d.

<b>VVOC<sub>28d</sub>: Further identified and calibrated substances in addition to LCI list/AgBB, substance specific calculated (C<sub>id sub</sub>)</b>			
-	-	-	n.d.

<b>VVOC<sub>28d</sub>: Not calibrated, identified substances calculated as toluene equivalent (C<sub>ni tol</sub>)</b>			
-	-	-	n.d.

Total very volatile organic compounds	Concentration (test chamber air) [µg/m <sup>3</sup> ]	SER <sub>a</sub> [µg/m <sup>2</sup> h]
<b>TVVOC<sub>28d</sub></b>	n.d.	n.d.

n.d. = not detectable

### 1.1.4.1 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 and Test chamber conditions:	see Volatile organic compounds
Analytics:	DIN ISO 16000-3
Limit of determination:	2 µg/m <sup>3</sup> ≈ 0,002 ppm

**Test result:**

Sample:	A001: Graphenstone Pintura Interior
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Substance	Concentration (Test chamber air) [µg/m <sup>3</sup> ]	Concentration (Test chamber air) [ppm]
Formaldehyde	< 2	< 0,002
Acetaldehyde	< 2	-

## 1.2 Ammonia

**Test parameter:**

Ammonia

**Test method:**

Analytics: UV/VIS Spectrometric analysis, Method of DIBt  
(German Institute for Structural Engineering)  
Limit of determination: 15 µg/m<sup>3</sup>

**Test result:**

<b>Sample:</b>	<b>Measurement after [days]</b>	<b>Concentration (Test chamber air) [µg/m<sup>3</sup>]</b>
A001: Graphenstone Pintura Interior	<b>28</b>	<b>&lt; 15</b>

## 2 Odour

### Test parameter:

Odour, test collective, odour test 28 days after test chamber loading

### Test method:

Preparation of test sample:	see 1.1. Volatile organic compounds
Test chamber conditions:	see 1.1. Volatile organic compounds
Air sampling:	28 days after test chamber loading
Analytics:	following DIN EN ISO 16000-28
Probands:	Quantity: 15 therefrom female: 6
Evaluation:	Acceptance Scale from +1 (clearly acceptable) to +0,1 (just acceptable) and from -0,1 (just unacceptable) to -1 (clearly unacceptable)

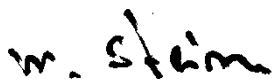
### Test result:

Sample: A001: Graphenstone Pintura Interior

	Acceptance
Arithmetical mean	0,7

	Acceptance
Arithmetical mean (background)	0,9
Standard deviation	0,2
half width of the 90% confidence interval	0,1

Cologne, 09.09.2015



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

### 3 Expert evaluation (M1)

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

This evaluation bases on the test criteria of the Building Information Foundation RTS.  
The results of the emission analysis are stated as Specific Emission Rate (SER).

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

Test parameter	Result	Requirement Emission class M1	Requirement hold [yes/no]
<b>Emission analysis</b>			
<b>Measurement time: 28 days after test chamber loading</b>			
TVOC (Sum volatile organic compounds) <sup>1)</sup>	< 0,0005 mg/m <sup>2</sup> h	< 0.2 mg/m <sup>2</sup> h	yes
Formaldehyde	< 0,002 mg/m <sup>2</sup> h	< 0.05 mg/m <sup>2</sup> h	yes
Ammonia	< 0,008 mg/m <sup>2</sup> h	< 0.03 mg/m <sup>2</sup> h	yes
Sum carcinogenic substances (EU cat. 1A and 1B)	< 0,0005 mg/m <sup>2</sup> h	< 0.005 mg/m <sup>2</sup> h	yes
<b>Odour test</b>			
<b>Measurement time: 2 days after test chamber loading</b>			
Odour	<b>Acceptance</b> 0,7	<b>Acceptance</b> > 0.0	yes

1) for TVOC only substances  $\geq 5 \mu\text{g}/\text{m}^3$  are considered

#### 3.1 Summary evaluation

The product **Graphenstone Pintura Interior** meets the requirements of the **Emission Class M1**.

Cologne, 09.09.2015



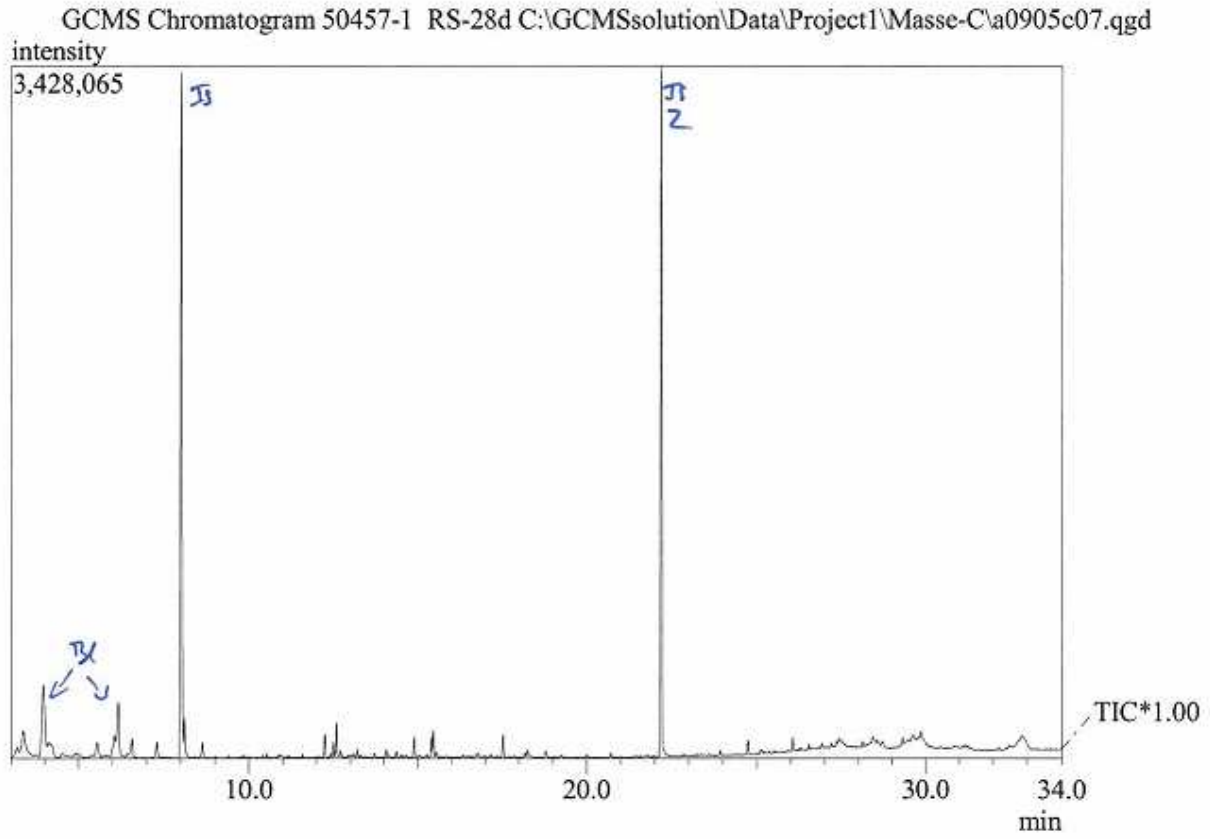
Tobias Rüsing, Dipl.-Geol.  
(Project Manager)

## **Annex A – Sampling protocol**

not available



## Annex B – Chromatograph, 28 days measurement point



## Annex C - Photo of the test specimen

