



Saint Ouen l'Aumone, the 4<sup>th</sup> of December 2013

**Evaluation of Volatile Organic Compounds and aldehydes emitted by a  
Lamina "Elegance, iroise gray, with a smooth finish " according to ISO  
16000**

Report N°D-101013-08326

Customer : SILVADEC SA – Ms POUDRÉ

Number of sample : 1

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## I- Objective

The objective of this test was to characterize and quantify the emissions of volatile organic compounds (VOCs) emitted by a **Lamina “Elegance, iroise gray, with a smooth finish”** to comply with to the decree N° 2011-321 of march 2011 and 19<sup>th</sup> april 2011. Emission ratings were established on the basis of measurements taken after 28 days in an emission test chamber. The aim was to classify emission rate from A+ to C, A+ indicating a very low level of emissions and C a high level of emissions. The level of emissions is indicated by the exposure concentration, expressed in  $\mu\text{g.m}^{-3}$ .

## II- Principle of the test

The **Lamina “Elegance, iroise gray, with a smooth finish”** was conditioned as described in the ISO 16000-9 method for 28 days in an emission test chamber under constant conditions of temperature, relative humidity and air flow rate per unit specific surface.

Samples of chamber air emissions were carried out after 28 days of conditioning according to ISO 16000-6 methods for VOC analysis method for testing ISO 16000-3 aldehydes.

The interpretation of the results was based on targets set by the table below.

Ratings	C	B	A	A+
Formaldehyde	>120	<120	<60	<10
Acetaldehyde	>400	<400	<300	<200
Toluene	>600	<600	<450	<300
Tetrachloroethylene	>500	<500	<350	<250
Xylene	>400	<400	<300	<200
1,2,4-Trimethylbenzene	>2,000	<2,000	<1,500	<1,000
1,4-Dichlorobenzene	>120	<120	<90	<60
Ethylbenzene	>1,500	<1,500	<1,000	<750
2-Butoxyethanol	>2,000	<2,000	<1,500	<1,000
Styrene	>500	<500	<350	<250
TVOC	>2,000	<2,000	<1,500	<1,000

## III- References

### a. Preparation of sample

NF EN ISO 16000-11 : Air intérieur – Partie 11 : Dosage de l’émission de composés organiques volatils de produits de construction et d’objets d’équipement – Echantillonnage, conservation des échantillons et préparation d’échantillons pour essais (AFNOR, août 2006).

### b. Conditioning


NF EN ISO 16000-9 : Air intérieur – Partie 9 : Dosage de l’émission de composés organiques volatils de produits de construction et d’objets d’équipement – Méthode de la chambre d’essai d’émission (AFNOR, août 2006).

### c. Sampling and analyse

NF ISO 16000-3 : Air intérieur – Partie 3 : Dosage du formaldéhyde et d’autres composés carbonylés –Méthode par échantillonnage actif (AFNOR, Décembre 2011).

NF ISO 16000-6 : Air intérieur – Partie 6 : Dosage des composés organiques volatils dans l’air intérieur des locaux et chambres d’essai par échantillonnage actif sur l’adsorbant Tenax TA, désorption thermique et chromatographie en phase gazeuse utilisant MS ou MS-FID (AFNOR, Mars 2012).

### IV- Description of sample

	<p><b>Lamina “Elegance, iroise gray, with a smooth finish”</b></p> 
No. of sample:	-
No sample Bureau Veritas (LIMS)	D-101013-08326-001 (64993)
Supplier Name:	SILVADEC
Commercial reference :	<b>Lamina “Elegance, iroise gray, with a smooth finish”</b>
Product Description:	Decking composite wood
Lot Number :	-
Sample selection process:	At random
Scenario	Outdoor flooring
Conditionning :	Aluminium + plastic
Manufacture date :	09/13/2013
Packing date :	10/02/2013
Volume of the chamber :	0,0509 m3
Conditioning period:	28 days
Beginning of the test:	31-oct.-13 (08:50)
End of test:	28-nov.-13 (08:50)
Relative Humidity:	50 ± 5 %
Temperature:	23 ± 2 °C
Name and address of the person who performed the sampling and analysis:	8, avenue de Bourgogne 95310 Saint Ouen l’Aumône <a href="mailto:christelle.nicolet@fr.bureauveritas.com">christelle.nicolet@fr.bureauveritas.com</a>

## V- Preparation of the test specimen

Reverse side and side of **Lamina “Elegance, iroise gray, with a smooth finish”** was covered of aluminium foil and was introduced in clean emission chamber.



**Figure 1 : Emission chamber with specimen**

## VI- Conditioning of sample

The sample was conditioned for 28 days in an emission chamber of 51 liter.  
The test parameters below have been applied:

<b>Test Parameters</b>	<b>Conditions</b>
Emission test chamber	CLIMPAQ en glass
Chamber Volume	0,0509 m <sup>3</sup>
Conditioning period	28 days
Relative Humidity	50 ± 5 %
Temperature	23 ± 2 °C
Scenario :	0,054 m <sup>2</sup>
Specimen surface	1,061 m <sup>2</sup> /m <sup>3</sup>
Loading rate	1,13 L/min
Airflow	0,2 m/s
Speed	Ground/Ceiling
Specific ventilation rate (q c)	1,25 m <sup>3</sup> /(m <sup>2</sup> .h)

## VII- Sampling conditions of VOCs and aldehydes

The VOC samplings were conducted according to NF ISO 16000-6. It was carried out in double on Tenax tube before the start of the trial (J0) and after  $28 \pm 2$  days (J28) of conditioning in the emission chamber.

Sampling	VOC
Number of tubes	2
Adsorbent support	Tenax TA
Duration of sampling	60 min
Sample flow	80 ml. min <sup>-1</sup>
Volume of sampled air	4.8 L

The samples of aldehydes were produced at the same time as the VOC samples on adsorbent cartridges impregnated with DNPH (2,4-dinitrophenylhydrazine) according to standard NF ISO 16000-3.

Sampling	Aldehydes
Number of tubes	1
Adsorbent support	DNPH
Duration of sampling	120 min
Sample flow	700 ml. min <sup>-1</sup>
Volume of sampled air	84 L

## VIII- Conditions of analyse of VOC and aldehydes sampling

The VOC analysis was performed using a Perkin Elmer thermodesorbeur 650 coupled to a GC Clarus 680/ MS Clarus 600C/FID Perkin Elmer according to NF ISO 16000-6. The tubes were heated by thermodesorbeur for 30 min at 280 ° C. This heating caused a desorption of volatile substances which are then passed through the chromatographic column and GC were detected by mass spectrometry (MS) and FID.



**Figure 2 : Photography of Thermal desorption System coupled to GC / MS / FID**

<b>Appliance</b>	<b>Parameter</b>	<b>Conditions</b>
Thermodesorbeur	Température Vanne	280°C
	Température tube	280°C
	Durée désorption tube	30 min
	Débit inlet split	40 ml/min
	Température cryogénie	- 30°C
	Température chauffage piège	300°C
	Rampe de chauffage piège	40°C/s
GC	Programmation de température GC	40°C pdt 2min 3°C/min jusqu'à 92°C 5°C/min jusqu'à 160°C 10°C/min jusqu'à 280°C 280°C pdt 10 min
	Colonne capillaire	colonne capillaire apolaire (phase stationnaire : 5% phenyl-methyl siloxane) 50 m x 0,32 mm x 0,52µm
MS	Scan	29 à 520 uma
	Inter scan time	0,1 s

Analysis of aldehydes was carried out according to standard NF ISO 16000-3. The cartridges were eluted in 5 ml of acetonitrile. Two injections of 20ul of the elution solution were then analyzed by high performance liquid chromatography (HPLC) on a Dionex system equipped with a UV detector diode array.

The aldehydes were identified and quantified by specific calibration.



**Figure 3 : Photography of HPLC**

Sampling	Aldehyde
Detector	UV-VIS diode array (360 nm)
Column	2 Phase inverse C18, 5µm, diameter = 4,6mm, L = 25 cm, tube Inox
Elution Flow	1 ml/min
Temperature of column	40°C

## IX- Test Results

### a. Exposure concentrations

$C_{exp}$  in  $\mu\text{g}\cdot\text{m}^{-3}$  is the concentration that would result in a model room defined in the decree of 19 avril 2011.

$$C_{exp} = SER / q_e$$

$q_e$  : Ventillation rate of model room ( $\text{m}^3\cdot\text{m}^2\cdot\text{h}^{-1}$ )

SER : Emission factor of VOC and aldehydes ( $\mu\text{g}\cdot\text{m}^{-2}\cdot\text{h}^{-1}$ )

$$SER = C_{mes} * q_c$$

$q_c$  : Ventillation rate of chamber ( $\text{m}^3\cdot\text{m}^2\cdot\text{h}^{-1}$ )

$C_{mes}$  : Concentration of VOC in emission chamber ( $\mu\text{g}\cdot\text{m}^{-3}$ )

N°CAS	Name of compound	tR (min)	C exp ( $\mu\text{g}/\text{m}^3$ )
			J 28
50-00-0	Formaldehyde <sub>COFRAC</sub>	11.51	6,4
75-07-0	Acetaldehyde	14.50	0,7
108-88-3	Toluene	9.69	1,8
127-18-4	Tetrachloroethylene	11.31	ND
1330-20-7	Xylenes (m-, o-, p-)	14.20 et 15.35	18,9
95-63-6	1,2,4-Trimethylbenzene	20.37	ND
106-46-7	1,4-Dichlorobenzene	21.33	ND
100-41-4	Éthylbenzene	13.82	6,3
111-76-2	2-Butoxyethanol	12.64	ND
100-42-5	Styrene	15.11	ND
Total VOC <sub>FID</sub>			679

- Wide absolute incertitude of formaldehyde: 20%.
- ND: Not Detected
- LQ formaldéhyde : 2.0  $\mu\text{g}/\text{m}^3$  et LD formaldéhyde : 0.5  $\mu\text{g}/\text{m}^3$
- LQ acétaldéhyde : 2.8  $\mu\text{g}/\text{m}^3$
- LQ other VOC : 1.0  $\mu\text{g}/\text{m}^3$
- Rt : Retention time



**Labelling of product:**

Concentrations of the 10 VOC bellow are inferior of A+ concentrations:

Futur étiquetage	C	B	A	A+
Formaldéhyde	>120	<120	<60	<10
Acétaldéhyde	>400	<400	<300	<200
Toluène	>600	<600	<450	<300
Tétrachloroéthylène	>500	<500	<350	<250
Xylène	>400	<400	<300	<200
1,2,4-Triméthylbenzène	>2000	<2000	<1500	<1000
1,4-Dichlorobenzène	>120	<120	<90	<60
Éthylbenzène	>1500	<1500	<1000	<750
2-Butoxyéthanol	>2000	<2000	<1500	<1000
Styrène	>500	<500	<350	<250
COVT	>2000	<2000	<1500	<1000

\* Information representative of the indoor air emissions of volatile substances posing an inhalation toxicity risk on a scale from C (high emissions) to A+ (very low emissions)

