

## Test Report

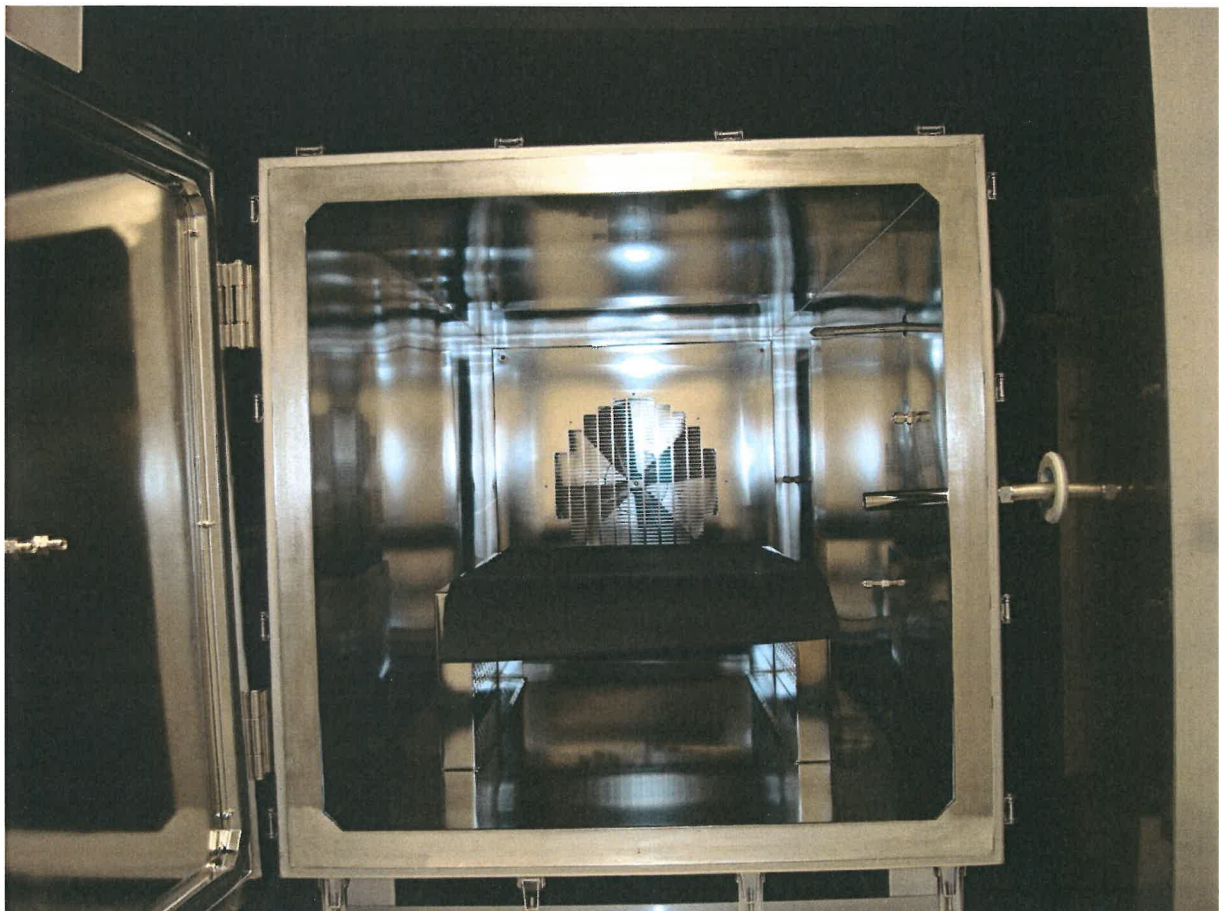
<b>Applicant:</b>	K – Flex Polska Sp. z o.o. Wielenin-Kolonia 50B 99-210 Uniejow Poland
<b>Content of Request:</b>	Product Emission Test <b>Determination of VOC</b> Data evaluation in accordance to the AgBB-Scheme In compliance with the French VOC regulation
<b>Material identification:</b>	K-Flex Solar HT – 10mm thick
<b>Origin of Product:</b>	K – Flex Polska Sp. z o.o. Wielenin-Kolonia 50B 99-210 Uniejow Poland Contact Person: Ms Nicoletta Fanelli
<b>Sampling:</b>	The samples were sent by applicant Arrival at FIW München on 02.03.2018 No. of arrival WE 18-3853
<b>Report No.:</b>	L1-18-059(E)
<b>Date of issue:</b>	07.08.2018
<b>Number of pages:</b>	9

## 1. Description of the Applied Testing Methods

The applied testing method complies with the test methods as defined by AgBB, in its interpretation by DIBt (Version: February 2015). The test method is based on the published methods DIN ISO 16000-3, ISO 16000-6, DIN EN ISO 16000-9, DIN EN ISO 16000-11, DIN EN ISO 16017-1 and EN 16516.

## 2. Test Specimen

A sample was sent by the client to the analytical Emissionlaboratory of FIW-München (Stamp documenting receipt of goods 02.03.2018). The sample was clearly labelled and packed in a carton, it was not damaged. The package was opened on March 13, 2018 and a test specimen (active surface 1m<sup>2</sup>) was cut out. The test specimen was transferred into the 1m<sup>3</sup> Emission-chamber (photo below).



### 3. Test Chamber

The test chamber has a volume of 1m<sup>3</sup> and was made of electropolished stainless steel. Before loading the chamber a blank value is checked. The operation parameters are: Temperature 23°C, Relative air humidity (supply air) 50%, Loading factor 1m<sup>2</sup>/m<sup>3</sup>, Air exchange rate 0,5 m<sup>3</sup>/h.

### 4. Sampling, Desorption, Analyses

#### 4.1 VOC Emissions Testing after 3 and 28 Days

The samples are taken on Tenax (ISO 16000-6) for the detection of VOC and SVOC. This analytic covered only organic substances that can be adsorbed on Tenax TA and can be thermally desorbed.

Analyses is done by Thermodesorption (TDS Gerstel) and Gaschromatography coupled with Massspectrometry (GC-MS Agilent, Column Rxi-5ms 60m, 0,25mm ID 0,25µm).

Additionally, air samples for the evaluation of aldehydes and ketones are taken on DNPH cartridges (DIN ISO 16000-3). Liquid desorption followed by High Performance Liquid Chromatography (HPLC) - UV detection.

Detected compounds were quantified by multi-point calibration with reference substances (TIC detection mode) or use the relative response factor of toluene, converting into toluene equivalents (decisive criteria: Toluene ≥ 5 µg/m<sup>3</sup>)

The results of the individual substances are calculated in three groups:

1. Very volatile organic compounds VVOC  
All substances appearing before n-hexane (n-C<sub>6</sub>)
2. Volatile organic compounds VOC  
All substances appearing between C<sub>6</sub> and C<sub>16</sub>
3. Semi volatile organic compounds SVOC  
All substances appearing between C<sub>16</sub> and C<sub>22</sub>

#### 4.2 Testing for Carcinogens after 3 and 28 days

The presence of carcinogens (EU Categories 1A, 1B and 2), as read from the latest publication on the homepages of the Institut für Arbeitsschutz IFA

(Institute for Occupational Safety and Health of the German Social Accident Insurance) will be assessed according to the following criteria:

Carcinogenic organic compounds EU-category 1A and 1B after 3 days  $\leq 10 \mu\text{g}/\text{m}^3$ ,  
Carcinogenic organic compounds EU-category 1A and 1B after 28 days  $\leq 1 \mu\text{g}/\text{m}^3$ .

## 5. Calculation of R – Values after 3 and 28 days on the basis of the German NIK table

The concentrations of all substances in the interval between n - C<sub>6</sub> and n - C<sub>16</sub> with more than  $5 \mu\text{g}/\text{m}^3$  are divided by their tabulated NIK – Values. The sum of the quotients gives the R – Value.

$$R = \sum_i (c_i/\text{NIK}_i + \dots + c_i/\text{NIK}_i) \leq 1$$

In parallel, all results are summed up for the substances without published NIK - Value

$$\sum_i^n \text{VOC}_{28} \leq 0.1 \text{ mg}/\text{m}^3$$

## 6. Quality assurance

The quality of the analyses to be carried out is permanently verified by means of control standards, certified reference materials, blank value checking (DIN EN ISO 16000-10) and regular calibrations.

## 7. Results

### 7.1 Emission Test after 3 Days

Sample: K-Flex Solar HT 10 mm thick	CAS Nr. Registry number	Re- tenti- on- time  min.	* C M R	Sub- stance- con- centration after 3days  µg/m³	Criteria	R 3 days  c/NIK	Emission- rate  µg/(m²h)	Toluene- equi- valent  µg/m³
					AgBB  µg/m³			
<b>TVOC (AgBB/DIBt) (C6-C16)</b>					≤ 10000	-	-	-
<b>[VVOC,VOC,SVOC]Sub- stances with NIK-Value</b>								
Phenol	108-95-2	18.3	2	1.2	-	-	0.6	-
3-Carene	13466-78-9	19.5	-	2.5	-	-	1.25	2.5
Acetic acid, 2ethylhexyl - ester	103-09-3	23.7	-	1.4	-	-	0.7	1.4
Formaldehyde	-	-	-	-	-	-	-	-
Acetaldehyde	-	-	-	-	-	-	-	-
<b>Total R = Σ Conc/ NIK</b>								
<b>VOC Substances without NIK-Value</b>								
Cyclotrisiloxane, hexa- methyl	541-05-9	11.5	-	2.5	-	-	1.25	2.5
Trimethylbicyclo- hept-2-ene	7785-26-4	16.5	-	2.0	-	-	1.0	2.0
1-Piperidinecarbonitrile	1530-87-6	23.5	-	4.1	-	-	2.1	4.1
2-Butenoic acid, 2- methoxy, methylester	56009-30-4	27.9	-	22.5	-	-	11.25	22.5
<b>Total VOC without NIK- Value</b>					-	-	-	-
<b>Total VVOC (&lt; n-C6)</b>					-	-	-	-
<b>Single VVOC Substances</b>								
Formaldehyde	-	-	-	-	-	-	-	-
Acetaldehyde	-	-	-	-	-	-	-	-

The results are only valid for the tested sample(s).

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Seite 5 von 9

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Propionaldehyde	-	-	-	-	-	-	-	-
Valeraldehyde	-	-	-	-	-	-	-	-
<b>Total SVOC (&gt; nC16)</b>					-	-	-	-
<b>Single SVOC Substances</b>								
<b>Carcinogens 1A+1B</b>	<b>(C6-C22)</b>				≤ 10	-	-	-
<b>Single CMR Substances</b>								
Formaldehyde	50-00-0	-	-1B/2	-	-	-	-	-
Acetaldehyde	75-07-0	-	2	-	-	-	-	-
Phenol	108-95-2		2	-	-	-	-	-
<b>Volatile Aldehydes measured with HPLC / DNPH-Method (see under 4.1)</b>								
Formaldehyde	50-00-0	-	1B/2	2.5	-	-	1.25	-
Acetaldehyde	75-07-0	-	2	100	-	-	50	-
Propionaldehyde	123-38-6	-	-	4	-	-	2	-
Valeraldehyde	110-62-3	-	-	1	-	-	0.5	-

## 7.2 Emission Test after 28 Days

<b>Sample: K-Flex Solar HT 10 mm thick</b>	<b>CAS Nr. Registry number</b>	<b>Re- tentio- on- time</b>	<b>* C M R</b>	<b>Sub- stance- concen- tration after 28 days</b>	<b>Criteria AgBB</b>	<b>R 28 days</b>	<b>Emission- rate</b>	<b>Toluene- equi- valent</b>
		min.		µg/m <sup>3</sup>	µg/m <sup>3</sup>	c/NIK	µg/(m <sup>2</sup> h)	µg/m <sup>3</sup>
<b>TVOC (AgBB/DIBt) (C6-C16)</b>					≤ 1000	-	-	-
<b>[VOC.VOC.SVOC]Sub- stances with NIK-Value</b>								
Phenol	108-95-2	18.3	2	bld	-	-	0.6	-
3-Carene	13466-78-9	19.5	-	bld	-	-	-	-
Acetic acid, 2ethylhexyl - ester	103-09-3	23.7	-	bld	-	-	-	-
Acetaldehyde	-	-	-	-	-	-	-	-
Formaldehyde	-	-	-	-	-	-	-	-

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Seite 6 von 9

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<b>Total R = <math>\Sigma</math> Conc<sub>i</sub> / NIK</b>					< 1			
<b>VOC Substances without NIK-Value</b>								
<b>Cydotrisiloxane, hexa-methyl</b>	541-05-9	11.5	-	1.5	-	-	0.75	1.5
<b>Trimethylbicyclohept-2-ene</b>	7785-26-4	16.5	-	bld	-	-	-	-
<b>1-Piperidinecarbonitrile</b>	1530-87-6	23.5	-	bld	-	-	-	-
<b>2-Butenoic acid, 2-methoxy, methylester</b>	56009-30-4	27.9	-	1.3	-	-	0.65	1.3
<b>Total VOC without NIK-Value <math>\Sigma</math> VOC<sub>28</sub></b>					$\Sigma \leq 100$	-	-	-
<b>Total VVOC (&lt; n-C6)</b>					-	-	-	-
<b>Single VVOC Substances</b>								
<b>Formaldehyde</b>	-	-	-	-	-	-	-	-
<b>Acetaldehyde</b>	-	-	-	-	-	-	-	-
<b>Propionaldehyde</b>	-	-	-	-	-	-	-	-
<b>Valeraldehyde</b>	-	-	-	-	-	-	-	-
<b>Total SVOC (&gt; nC16)</b>					$\leq 100$	-	-	-
<b>Single SVOC Substances</b>								
<b>Carcinogens 1A+1B</b>	<b>(C6-C22)</b>				$\leq 1$	-	-	-
<b>Single CMR Substances</b>								
<b>Formaldehyde</b>	-	-	1B/2	-	-	-	-	-
<b>Acetaldehyde</b>	-	-	2	-	-	-	-	-
<b>Volatile Aldehydes measured with HPLC / DNPH-Method (see under 4.1)</b>								
<b>Formaldehyde</b>	50-00-0	-	1B/2	1.2	-	-	0.6	-
<b>Acetaldehyde</b>	75-07-0	-	2	60	-	-	30	-
<b>Propionaldehyde</b>	123-38-6	-	-	4	-	-	2	-
<b>Valeraldehyde</b>	110-62-3	-	-	0.5	-	-	0.25	-

\* Carcinogen. Mutagen. Reprotoxic: EU-category GHS Regulation 1272/2008 IFA CMR – List (status 2016)  
IFA: Institute for Occupational Safety and Health of the German Social Accident Insurance

AgBB: Committee for Health-related Evaluation of Building Products  
DIBt: Deutsches Institut für Bautechnik "German Institute for Civil Engineering"  
GHS: Globally Harmonized System of Classification and Labelling of Chemicals  
NIK  $\triangleq$  LCI: Lowest Concentration of Interest  
CAS: Chemical Abstracts Service  
bld: below limit of detection

## 8. VOC Emission Class According to the French labelling System after 28 Days

Probe: K-Flex Solar HT 10mm thick	Konzentration $\mu\text{g}/\text{m}^3$	C	B	A	A+
Formaldehyde CAS: 50-00-0	1	>120	<120	<60	<10
Acetaldehyde CAS: 75-07-0	60	>400	<400	<300	<200
Toluene CAS: 108-88-3	bld	>600	<600	<450	<300
Tetrachloroethylene CAS: 127-18-4	bld	>500	<500	<350	<250
Ethylbenzene CAS: 100-41-4	bld	>1500	<1500	<1000	<750
Xylene CAS: 1330-20-7	bld	>400	<400	<300	<200
Styrene CAS: 100-42-5	bld	>500	<500	<350	<250
2-Butoxyethanol CAS: 111-76-2	bld	>2000	<2000	<1500	<1000
Trimethylbenzene CAS: 95-63-6	bld	>2000	<2000	<1500	<1000
1,4 Dichlorobenzene CAS: 106-46-7	bld	>120	<120	<90	<60
TVOC	bld	>2000	<2000	<1500	<1000

### 8.1 Absence of Release of CMR Compounds

Probe: K-Flex Solar HT 10mm thick	CAS Nr.	Konzentration $\mu\text{g}/\text{m}^3$	Emissionsrate $\mu\text{g} (\text{m}^2 \text{h})$
Benzene	71-43-2	bld	-
Trichlorethylene	79-01-6	bld	-

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Diethylhexylphthalate DEHP	117-81-7	bld	-
Dibutylphthalate DBP	84-74-2	bld	-

bld: below limit of detection

## 9. Interpretation of the Results

The classification value R for the (VOC.VOC.SVOC with NIK) substances with more than 5 µg/m<sup>3</sup> after 28 days is below the classification threshold of 1.

The formaldehyde emission after 28 days is below the classification threshold of 100 µg/m<sup>3</sup>.

The tested product K-Flex SOLAR HT – 10mm thick complies with the requirements of **DIBt / AgBB – scheme 2015**.

*The product is suitable for indoor use in buildings.*

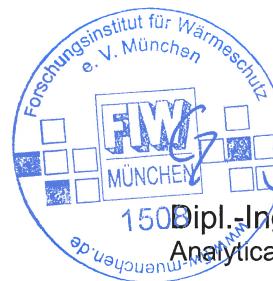
*The French VOC Emission Class is A+*

Testing results relate only to those submitted laboratory samples which have been labelled as tested. The average temperature during the entire testing period shall not deviate from the target value of 23°C by more than ± 1°C.

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Gräfelfing, 07<sup>th</sup> August 2018

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Head of Department



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Analytical Test Report