BELAC 633-TEST

# Emission test report of an Arktura sample Atmosphera and Softgrid series

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ML01911-01R

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Servaco Product Testing is  a joint venture between VITO and the Servaco Group. The new company focusses on product emission testing and VOC reduction performance testing. The product emission tests analyse the impact of all kinds of building and consumer products and materials on indoor air quality. The Joint Venture has departments in Mol and Wetteren. The product emission tests are performed in Mol.

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# 1. OBJECTIVE/EVALUATION FRAMEWORK

Determination of the volatile organic compound emissions for the Arktura sample Atmosphera and Softgrid series according to the French and Italian regulations, the German AgBB health evaluation procedure/ABG, the Finnish M1 protocol and the BREEAM and LEED requirements.

| | |
|---|---|
| **French VOC regulations** | Arrêté du 28 mai 2009 modifiant l'arrêté du 30 avril 2009, Arrêté du 20 février 2012 modifiant l'arrêté du 19 avril 2011, Décret no 2011-321 du 23 mars 2011) |
| **German AgBB (2018)/ABG** | Anforderungenan bauliche Anlagen bezüglich des Gesundheitsschutzes ABG), Entwurf 31.08.17 |
| **Italian regulation (public procurement)**<br>**LEED v4.0 (outside U.S.)** | Italian Decree on Green Public Procurement issued in January 2016 (21-1-2016 GAZZETTA UFFICIALE DELLA REPUBBLICA ITALIANA Serie generale - n. 16) |
| **BREEAM International: VOC emissions requirements** | BREEAM International New Construction 2016 manual and GN22: BREEAM Recognised Schemes for Emissions from Building Products v2.2 August 2017 |
| **LEED v4.0 (outside U.S.): VOC emissions requirements** | LEED v4 for BUILDING DESIGN AND CONSTRUCTION Updated April 6, 2018 and LEED v4 EQ Credit Low-Emitting Materials Third Party Certifications and Labels v June 2017 |
| **M1** | M1 Emission Classification of Building Materials: Protocol for Chemical and Sensory Testing of Building Materials Version 15.11.2017 + CMR update January 2019 |

# 2. SAMPLE INFORMATION

*Table 1: Sample information provided by client*

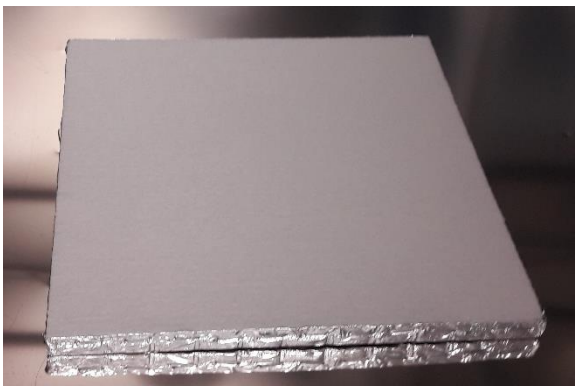
S1

| **Sample identification** | **Atmosphera and Softgrid series** |
|---|---|
| **Date of production** | 04/09/2019 |
| **Date of sampling** | 04/09/2019 |
| **Batch N°** | 002 |
| **Type of product** | Acoustic Modular Ceiling System |
| **Article nr.** | / |
| **Misc.** | / |

*Table 2: Sample information provided by Servaco Product Testing*

| **Sample group code** | **SPT2019162** |
|---|---|
| **Sample code** | SPT20192062 |
| | |
| **Date of reception of the sample** | 12/09/2019 |
| **Preconditioning period (start – end)** | / |
| **Date of the test (start – end)** | 24/09/2019-22/10/2019 |

*Photograph 1: test sample S1*



The product Atmosphera and Softgrid series was selected by the Finnish M1 classification working group to cover the product range (group 1) described below:

Group 1 (PET Primary)

1. Soft Fold
2. Tri-Soft
3. Softgrid – Flux
4. Soft Grid – Deca
5. Soundstar
6. Softgrid – Skyline
7. Sound Edge
8. Softgrid – Wave
9. Softgrid – Orbit
10. Softgrid – Switch
11. Softgrid – Scale
12. Softgrid – Square
13. SoundAngle
14. Atmosphera – Surf
15. Atmosphera – Strata
16. Softplanes
17. Atmosphera – Flow: to be tested
18. Atmosphera – Rise
19. Atmosphera – Swell
20. Softgrid – Round
21. Softgrid – Slope
22. Softgrid – Dome
23. Atmosphera – Linea
24. Softgrid – Sine

Group 2 (Al Primary)

1. Vapor Soft – Cora
2. Vapor Soft – Cluster
3. Vapor Soft – Trail
4. Vapor Trail
5. Vapor Pixel
6. Vapor – Cumula
7. Delta Drop 4x4
8. Vapor – Byte
9. Delta Drop 2x4
10. Vapor – Cluster: to be tested
11. Vapor- Syntax
12. Trace – Slant
13. Trace – Skew
14. Trace – Straight
15. Vapor – Shift
16. Trace – Curved

# 3. TEST METHODS - ACCREDITATION

The following test methods were used:

- Test chamber was operated according to EN 16516 (2017) (ISO 16000-9 with extra clauses): Construction products – Assessment of release of dangerous substances – Determination of emissions into indoor air (internal procedure MIM-GA-013)
- Analysis of TENAX samples was performed according to EN 16516 (2017) (ISO 16000-6 with extra clauses): Construction products – Assessment of release of dangerous substances – Determination of emissions into indoor air (internal procedure MIM-GA-014)
- Analysis of DNPH cartridges was performed according to EN 16516 (2017) (ISO 16000-3): Construction products – Assessment of release of dangerous substances – Determination of emissions into indoor air (internal procedure MIM-OR-022)
- The test sample preparation was performed according to EN 16516 (2017) (ISO 16000-11 with extra clauses): Construction products – Assessment of release of dangerous substances – Determination of emissions into indoor air (internal procedure MIM-GA-013)

*Table 3: Overview of the test method parameters*

**EN 16516 method**

| **Analytical methods** | **analytes** |
|---|---|
| ISO 16000-3 | Volatile aldehydes (C1-C4) |
| ISO 16000-6 + extra clauses | VOC, SVOC |
| **Test chamber parameters** | **values** |
| | S1 |
| Chamber volume ($m^3$) | 0.11 |
| Air exchange rate ($h^{-1}$) | 0.5 |
| Temperature (°C) | 23 ± 1 |
| Relative humidity (%) | 50 ± 5 |
| Loading factor ($m^2/m^3$) | 0.4 |
| **Sample preparation** | |
| Dimensions ($m^2$) | 0.21 x 0.21 |
| Application amount (g) | / |

Servaco Product Testing is an accredited laboratory according to EN ISO/IEC 17025 (BELAC 633-TEST) for the internal procedures MIM-GA-013 and MIM-GA-014. The analysis of DNPH cartridges (internal procedure MIM-OR-022) was subcontracted to VITO and is part of their EN ISO/IEC 17025 accreditation scope (BELAC 045-TEST). At present the accreditation does not cover the compounds marked with *, however analysis for these compounds was performed at the same level of quality as for the accredited compounds. The analytical measurement uncertainty (expanded uncertainty) for volatile aldehydes amounts to maximum 15 % and 30 % for the other target compounds.

# 4. RESULTS

## 4.1. VOC EMISSION RESULTS AFTER 3 DAYS

| VOC analysis after 3 days | | | | | | |
|---|---|---|---|---|---|---|
| S1 | CAS number | RT | Id[1] | Conc. (µg/m³) | $SER_a$ (µg/m²h) | $R_i$ |
| **VOC with LCI[2]** | | | | | | |
| - | - | - | - | - | - | - |
| **VVOC with LCI** | | | | | | |
| Formaldehyde | 50-00-0 | 2.2 | 1 | <1 | / | |
| Acetaldehyde | 75-07-0 | 3.1 | 1 | <1 | / | |
| **VOC without LCI (non-assessable)[2]** | | | | | | |
| Silane,dimethoxydimethyl-* | 1112-39-6 | 8.0 | 2 | 7 | 8 | - |
| **VVOC without LCI** | | | | | | |
| - | - | - | - | - | - | - |
| **Non identified** | | | | | | |
| - | - | - | - | - | - | - |
| **Sum of VOCs without LCI** | | | | 7 | 8 | |
| **TVOC ISO 16000-6** | | | | 19 | 24 | |
| **TVOC EN 16516 option 1** | | | | 7 | 8 | |
| **TVOC G (AgBB)** | | | | 7 | 8 | |
| **R value B** | | | | | | - |
| **R value G** | | | | | | - |
| **Carcinogens** | | | | <1 | / | |
| **benzene** | | | | <1 | / | |
| D.L.: detection limit < 0.5 µg/m³<br>Q.L.: quantification limit < 1 µg/m³ | | | | | | |

[1] Identification:
- 1: identification by standard solution and retention time, confirmed by spectrum library and specifically calibrated
- 2: identification by comparison with spectrum library and plausibility declaration, calibrated as toluene equivalent
- 3: not identified, calibrated as toluene equivalent

[2] Compounds marked with an * are not part of the accreditation

## 4.2. VOC EMISSION RESULTS AFTER 28 DAYS

| VOC analysis after 28 days | | | | | | |
|---|---|---|---|---|---|---|
| S1 | CAS number | RT | Id[3] | Conc. (µg/m³) | $SER_a$ (µg/m²h) | $R_i$ |
| **VOC with LCI[4]** | | | | | | |
| - | - | - | - | - | - | - |
| **VVOC with LCI** | | | | | | |
| Formaldehyde | 50-00-0 | 2.2 | 1 | <1 | / | |
| Acetaldehyde | 75-07-0 | 3.1 | 1 | <1 | / | |
| **VOC without LCI (non-assessable)[2]** | | | | | | |
| Silane,dimethoxydimethyl-* | 1112-39-6 | 8.0 | 2 | 15 | 19 | |
| Cyclotrisiloxane,hexamethyl-* | 541-05-9 | 13.1 | 2 | 6 | 7 | |
| **VVOC without LCI** | | | | | | |
| - | - | - | - | - | - | - |
| **Non identified** | | | | | | |
| - | - | - | - | - | - | - |
| **Sum of VOCs without LCI** | | | | 21 | 26 | |
| **TVOC Fr** | | | | 40 | 50 | |
| **TVOC B** | | | | 21 | 26 | |
| **TSVOC B** | | | | <5 | / | |
| **TVOC G (AgBB)** | | | | 21 | 26 | |
| **TSVOC G (AgBB)** | | | | <5 | / | |
| **R value B** | | | | | | - |
| **R value G** | | | | | | - |
| **carcinogens** | | | | <1 | / | |
| **benzene** | | | | <1 | / | |
| D.L.: detection limit < 0.5 µg/m³<br>Q.L.: quantification limit < 1 µg/m³ | | | | | | |

[3] Identification:
- 1: identification by standard solution and retention time, confirmed by spectrum library and specifically calibrated
- 2: identification by comparison with spectrum library and plausibility declaration, calibrated as toluene equivalent
- 3: not identified, calibrated as toluene equivalent

[4] Compounds marked with an * are not part of the accreditation

# 5. EVALUATION OF THE RESULTS

## 5.1. COMPARISON WITH LIMIT VALUES OF FRENCH LEGISLATION

| Compound[5] | CAS number | Id[6] | Concentration (µg/m³) | Classification Fr |
|---|---|---|---|---|
| **Formaldehyde** | 50-00-0 | 1 | <1 | $A^+$ |
| **Acetaldehyde** | 75-07-0 | 1 | <1 | $A^+$ |
| **Toluene** | 108-88-3 | 1 | <1 | $A^+$ |
| **Tetrachloroethylene** | 127-18-4 | 1 | <1 | $A^+$ |
| **Ethylbenzene** | 100-41-4 | 1 | <1 | $A^+$ |
| **Xylene** | 1330-20-7 | 1 | <1 | $A^+$ |
| **Styrene** | 100-42-5 | 1 | <1 | $A^+$ |
| **2-Butoxyethanol** | 111-76-2 | 1 | <1 | $A^+$ |
| **1,2,4-Trimethylbenzene** | 95-63-6 | 1 | <1 | $A^+$ |
| **1,4-Dichlorobenzene** | 106-46-7 | 1 | <1 | $A^+$ |
| **Trichloroethylene** | 79-01-6 | 1 | <1 | $A^+$ |
| **Benzene** | 71-43-2 | 1 | <1 | $A^+$ |
| **Bis(2-ethylhexyl)phthalate*** | 117-81-7 | 1 | <1 | $A^+$ |
| **Dibutyl phthalate*** | 84-74-2 | 1 | <1 | $A^+$ |
| **TVOC** | | 2 | 40 | $A^+$ |

[5] Compounds marked with an * are not part of the accreditation

[6] Identification:

- 1: identification by standard solution and retention time, confirmed by spectrum library and specifically calibrated
- 2: identification by comparison with spectrum library and plausibility declaration, calibrated as toluene equivalent
- 3: not identified, calibrated as toluene equivalent

## 5.2. COMPARISON WITH LIMIT VALUES OF ITALIAN PANGPP

| Compound[7] | CAS number | Id[8] | Concentration (µg/m³) | Classification It |
|---|---|---|---|---|
| **Formaldehyde** | 50-00-0 | 1 | <1 | (<60): √ |
| **Acetaldehyde** | 75-07-0 | 1 | <1 | (<300): √ |
| **Toluene** | 108-88-3 | 1 | <1 | (<450): √ |
| **Tetrachloroethylene** | 127-18-4 | 1 | <1 | (<350): √ |
| **Ethylbenzene** | 100-41-4 | 1 | <1 | (<1000): √ |
| **Xylene** | 1330-20-7 | 1 | <1 | (<300): √ |
| **Styrene** | 100-42-5 | 1 | <1 | (<350): √ |
| **2-Butoxyethanol** | 111-76-2 | 1 | <1 | (<1500): √ |
| **1,2,4-Trimethylbenzene** | 95-63-6 | 1 | <1 | (<1500): √ |
| **1,4-Dichlorobenzene** | 106-46-7 | 1 | <1 | (<90): √ |
| **Trichloroethylene** | 79-01-6 | 1 | <1 | (<1): √ |
| **Benzene** | 71-43-2 | 1 | <1 | (<1): √ |
| **Bis(2-ethylhexyl)phthalate*** | 117-81-7 | 1 | <1 | (<1): √ |
| **Dibutyl phthalate*** | 84-74-2 | 1 | <1 | (<1): √ |
| **TVOC** | | 2 | 40 | (<1500): √ |

## 5.3. COMPARISON WITH LIMIT VALUES OF GERMAN AGBB (2018)/ABG LEGISLATION

Since the products don't contain a significant proportion of organic substances – as evidenced by the VOC statements/reports of their powder coatings and the emission report of Soft Sound Acoustic Panel showing very low VOC emissions (TVOC < 10 µg/m³ after 14 days) - the emission test is not needed for the German market .

| AgBB S1 Parameter | Test after 3 days | | Test after 28 days | |
|---|---|---|---|---|
| | Concentration (µg/m³) | Limit value (µg/m³) | Concentration (µg/m³) | Limit value (µg/m³) |
| R –value (dimensionless) | | - | - | ≤ 1 |
| TVOC | 7 | ≤ 10000 | 21 | ≤ 1000 |
| TSVOC | | - | <5 | ≤ 100 |
| Total carcinogens | <1 | ≤ 10 | <1 | ≤ 1 |
| TVOC without LCI | | - | 21 | ≤ 100 |
| Formaldehyde | | - | <1 | ≤ 120 |

[7] Compounds marked with an * are not part of the accreditation

[8] Identification:

- 1: identification by standard solution and retention time, confirmed by spectrum library and specifically calibrated
- 2: identification by comparison with spectrum library and plausibility declaration, calibrated as toluene equivalent
- 3: not identified, calibrated as toluene equivalent

## 5.4. COMPARISON WITH LIMIT VALUES OF M1

| Analysis of the NH3 after 28 days | | |
|---|---|---|
| Analyte | CAS number | Concentration (µg/m³) |
| **$NH_3$** | 7664-41-7 | <q.l. |

| | Acceptability | | Acceptability |
|---|---|---|---|
| Panel member 1 | 0.80 | Panel member 11 | 1.00 |
| Panel member 2 | 0.20 | Panel member 12 | 0.95 |
| Panel member 3 | 0.95 | Panel member 13 | 0.90 |
| Panel member 4 | 0.70 | Panel member 14 | 0.90 |
| Panel member 5 | 1.00 | Panel member 15 | 1.00 |
| Panel member 6 | 0.90 | Panel member 16 | 1.00 |
| Panel member 7 | 1.00 | Panel member 17 | 0.80 |
| Panel member 8 | 0.20 | Panel member 18 | 0.85 |
| Panel member 9 | 1.00 | Panel member 19 | 0.50 |
| Panel member 10 | 0.70 | Panel member 20 | 0.80 |
| Arithmetic mean of acceptability: 0.81<br>Standard deviation: 0.25<br>90% confidence interval: 0.71-0.90 | | | |

| S1 Compound | CAS number | Identification[9] | Emission rate (mg/m²h) | Emission rate M1 (mg/m²h) | Emission rate M2 (mg/m²h) |
|---|---|---|---|---|---|
| **TVOC** | | 2 | 0.026 | <0.2 | <0.4 |
| **Formaldehyde** | 75-07-0 | 1 | <0.001 | <0.05 | <0.125 |
| **Ammonia** | 7664-41-7 | 1 | <0.03 | <0.03 | <0.06 |
| **Carcinogenic compounds** | 126-99-8 | 1 | <0.001 | <0.001 | <0.001 |
| **Single VOC** | | | <EU-LCI | ≤EU-LCI | ≤EU-LCI |
| **Odour (dimensionless)** | | | 0.81 | 0.0 | 0.0 |

[9] Identification:
- 1: identification by standard solution and retention time, confirmed by spectrum library and specifically calibrated
- 2: identification by comparison with spectrum library and plausibility declaration, calibrated as toluene equivalent
- 3: not identified, calibrated as toluene equivalent

### 5.5. COMPARISON WITH EMISSION CRITERIA OF BREEAM INTERNATIONAL

M1 is a BREEAM Recognised Scheme for emissions from building products.

| | VOC emission compliant | BREEAM compliant |
|---|---|---|
| **M1** | √ | Not determined |

### 5.6. COMPARISON WITH EMISSION CRITERIA OF LEED V4 (OUTSIDE US)

Projects outside the U.S. may use products tested and deemed compliant in accordance with either (1) the CDPH standard method (2010) or (2) the German AgBB Testing and Evaluation Scheme (2010). Test products either with (1) the CDPH Standard Method (2010), (2) the German AgBB Testing and Evaluation Scheme (2010), (3) ISO 16000-3: 2010, ISO 16000-6: 2011, ISO 16000-9: 2006, ISO 16000-11:2006 either in conjunction with AgBB, or with French legislation on VOC emission class labeling, or (4) the DIBt testing method (2010).

M1 is an acceptable certification and program for EQ Credit Low Emitting Materials.

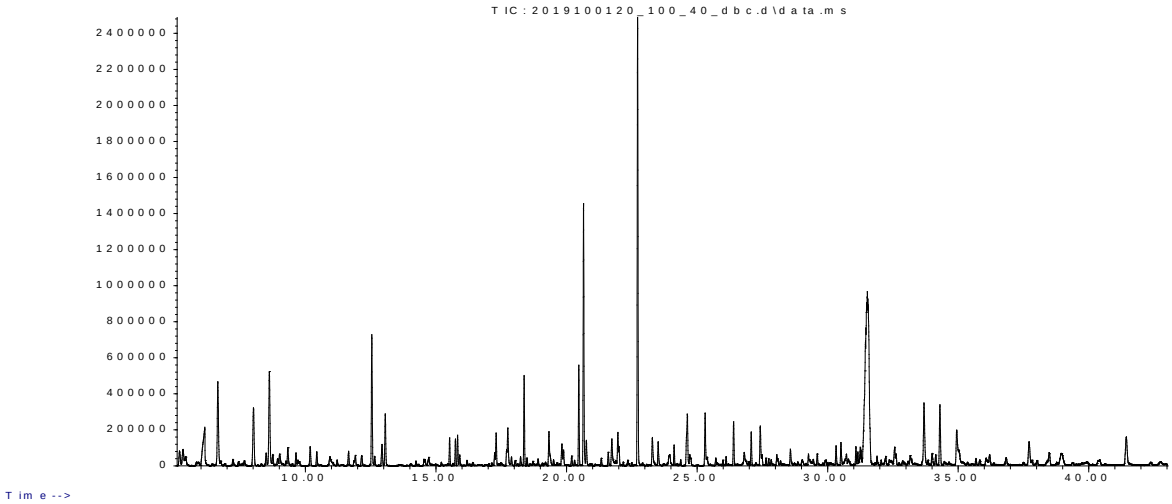
| | VOC emission compliant | LEED compliant |
|---|---|---|
| **M1 + low formaldehyde requirement** | √ | Not determined |

# 6. APPLIED LCI/NIK VALUES

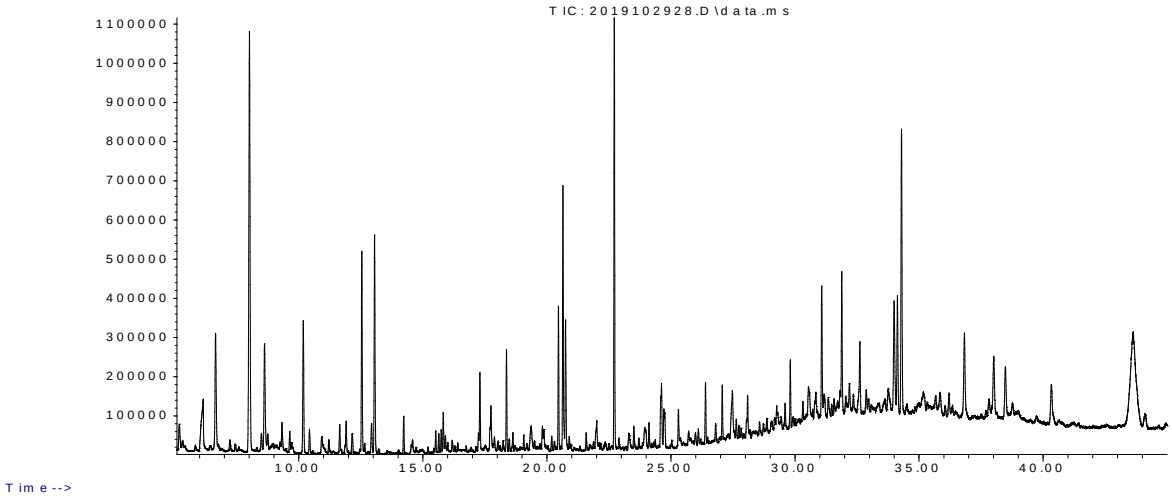
| Compound | CAS number | AgBB NIK 2018 (µg/m³) | Belgian LCI (µg/m³)) |
|---|---|---|---|
| **VOC compounds** | | | |
| - | - | - | - |

# 7. CHROMATOGRAMS

S1 3 days




S1 28 days



# 8. CONCLUSIONS

In the final table below is shown whether the products comply with the German and Italian regulations, and which label they get according to the French regulations. In addition it is also shown if the product complies with the VOC emission requirements of BREEAM International and LEED v4.0 (outside U.S.).

| | S1 |
|---|---|
| French regulations | $A^+$ |
| Italian regulations | √ |
| M1 | M1 |
| BREEAM | √ |
| LEED | √ |
| AgBB/ABG | √ |

X : not compliant
√ : compliant

The sample complies with the French $A^+$ classification, is compliant with the German and Italian legislations, complies with the M1 label and with the BREEAM and LEED low VOC emissions criteria.

According to the decision rule defined in the contract, for the above statements of conformity the measurement uncertainty was not taken into account.

# 9. AUTHORISATION OF REPORT

This report contains the results of samples, analysed within the scope of a study ordered by Arktura BV (RDM Innovation Dock, Scheepsbouwweg 8 I D11, 3089 JW Rotterdam, The Netherlands). It relates to the sample(s) with the following Servaco Product Testing - identification:

| **Sample monster codes belonging to sample group SPT2019162** | |
|---|---|
| From | To |
| SPT20192062 | SPT20192062 |

Servaco Product Testing is an accredited laboratory according to EN ISO/IEC 17025 (BELAC 633-TEST) for the internal procedures MIM-GA-013 and MIM-GA-014. The analysis of DNPH cartridges (internal procedure MIM-OR-022) was subcontracted to VITO and is part of their EN ISO/IEC 17025 accreditation scope (BELAC 045-TEST).

The analytical results in this research report only relate to the samples analysed. Interpretations, advice and other not merely objective information are not covered by the EN ISO/IEC 17025 accreditation. Further information on measurement uncertainty and sample preservation will be provided upon request.

Dates of analysis:

- DNPH: 04/10/2019 and 25/10/2019
- Tenax: 01/10/2019 and 29/10/2019

This research report consists of 17 numbered pages, and the signature below confirms the authorisation of the analytical results according to EN ISO/IEC 17025.

M. Lor
Managing Director Servaco Product Testing