



**PROFTECH**  
SPÓŁKA Z O.O.



AB 994

Research laboratory  
accredited by PCA, Nr AB  
994

Scopes of accreditation:

- concentration and mass measurements of flow of fine particles
- measurements of concentration and mass flow of SO<sub>2</sub>, NO<sub>x</sub>, CO
- concentration measurements of CO<sub>2</sub>, O<sub>2</sub>
- concentration and mass flow measurements of OWO
- sampling for mass concentration determination of PCDD/PDF and dioxin type PCB
- sampling for concentration determination of (As; Cd; Cr; Co; Cu; Mn; Ni; Pb; Sb; Ti; V)
- sampling for concentration determination of Hg
- sampling and determination of concentration and mass flow of HCl
- sampling and determination of concentration and mass flow of HF
- sampling for determining the concentration of individual gaseous organic compounds
- calibration of Automated Monitoring systems,
- QAL2 procedure
- annual performance test of Automated Monitoring Systems, AST procedure
- noise measurement from machinery, installations and industrial plants

Chorzów, May 22<sup>nd</sup> 2023  
Our ref. No.: PW/41/05/23

### **Report No PW/41/05/23**

**on concentration measurements of dioxins and furans emitted into environment from flue gas channel located at UAB GREN KLAIPEDA, Kretainio g. 3 LT-94103, Klaipeda, Lithuania.**

Client name and address:

**UAB "GREN KLAIPEDA"**

Kretainio g. 3,  
LT-94103 Klaipeda

Developed by:

mgr Grzegorz Bortel

Calculation and data transfer checked by:

inż. Dariusz Guja

Verified by:

inż. Dariusz Guja

**DYREKTOR**

Dariusz Guja

Copy number: ..... *1/3* .....

ul. Kurta Aldera 44  
41-506 Chorzów  
tel/fax: 0 32 247 37 24

www.proftech.com.pl  
e-mail: proftech@proftech.com.pl

NIP: 627 252 46 31  
KRS: 0000773369

bank account : PKO BANK POLSKI S.A. O/Katowice : IBAN PL62 1440 1172 0000 0000 0353 4332

---

**Test Report No PW/41/05/23**

---

**List of contents:**

- 1. PURPOSE AND SCOPE OF THE REPORT**
- 2. BASIS OF MEASUREMENTS EXECUTION**
- 3. MEASUREMENT TEAM**
- 4. MEASUREMENT RESULTS SUMMARY**
- 5. DESCRIPTION OF THE MEASUREMENT METHOD**
- 6. MEASUREMENT RESULTS**
- 7. MEASUREMENT DEVICES**
- 8. ANALYSIS RESULTS**
- 9. CERTIFICATE OF ACCREDITATION**
- 10. MEASUREMENT PLANE SCHEME**



**Test Report No PW/41/05/23****1. PURPOSE AND SCOPE OF THE REPORT**

Purpose of executed measurements was to determine the concentration and emission of dioxins and furans emitted to environment from flue gas channel located at UAB GREN KLAIPEDA, Kretainio g. 3 LT-94103, Klaipeda, Lithuania

*Measurements range:*

- PCDD/DF emission and concentration.

The measurements were carried out in accordance with the sampling plan and the described sampling methods.

Operating parameters of the technological installation was obtained from the customer's representative.

**2. BASIS OF MEASUREMENTS EXECUTION**

The measurements were taken according to the Purchase Order No MX27936LTKLJ21 dated May 07<sup>th</sup> 2021, our reference number PP/01/05/21.

**3. MEASUREMENT TEAM**

The measurements taken on April 25<sup>th</sup> 2023 were executed by the following team:

- Grzegorz Bortel            specialist- measurement team leader,
- Bartłomiej Glik            specialist,
- Grzegorz Kurzeja        specialist.

**4. MEASUREMENT RESULTS SUMMARY**

Below are presented measurement results summary, full measurement results are presented in chapter no 6, at page 8.

Concentration of the substance in the gas in the reference conditions O2 ref. 11%	PCDDF	ng/m3	<b>0,0014</b>
Emission limits	PCDDF	ng/m3	<b>0,1</b>
Transgerssion	PCDDF	ng/m3	-

---

**Test Report No PW/41/05/23**

---

**5. DESCRIPTION OF THE MEASUREMENT METHOD****Measurement of the gas volumetric flow**

The flow rate was determined according to ISO Standard PN-EN ISO 16911-1:2013 „Stationary source emissions - Manual and automatic determination of velocity and volume flow rate in ducts - Part 1: Manual reference method". Gravimetric dust monitor type Megasystem APIS X-1 and type "S" Pitot tube were used for the measurements. Measurement is accredited.

Accreditation range: differential pressure: > 5 Pa

**Measurement O<sub>2</sub> content**

The concentration of O<sub>2</sub> was determined using gas analyzer HORIBA PG-350E-EU equipped with testing probe 1750 mm long. The measurements were taken according to the procedure described in measurement unit as well as to Polish Standard PN-EN 14789:2017 "Stationary source emissions - Determination of volume concentration of oxygen O<sub>2</sub> - Reference method - Paramagnetism". Measurement is accredited.

Accreditation range: O<sub>2</sub> content: 3-21%

**Measurement CO<sub>2</sub> content**

The concentration of CO<sub>2</sub> was determined using gas analyzer HORIBA PG-350E-EU equipped with testing probe 1750 mm long. The measurements were taken according to the procedure described in measurement unit as well as to Polish Standard PN-ISO 10396:2001 "Stationary Source Emissions - Sampling For The Automated Determination Of Gas Concentrations ". Measurement is accredited.

Accreditation range: CO<sub>2</sub> content: 0,1-20%

**Measurement moisture content**

Moisture content was determined using condensation-absorption method. The measurements were taken according to Polish Standard PN-EN 14790:2017. Measurement is accredited.

Accreditation range: H<sub>2</sub>O content: 29-250 g/m<sup>3</sup>



---

**Test Report No PW/41/05/23**

---

**PCDD+PCDF sampling and determination**

PCDD/DF samples were taken according to the requirements of Polish Standard PN-EN 1948-1:2006 „ Stationary source emissions - Determination of mass concentration of PCDDs/PCDFs and dioxin-type PCBs - Part 1: Sampling of PCDDs/PCDFs”.

*The three stages of PCDD/DF concentration and emission determination:*

**Stage I - sampling**

For the determination of mass concentration of PCDD/DF proper sampling plays important role that affects following stages of the testing. The sampling were performed by means of the filtration and condensation method using PCDD/DF sampling system conformed to European Standard PN-EN 1948-1:2006.

The following page shows the schematic diagram of the sampling system.

**Stage II - laboratory analysis**

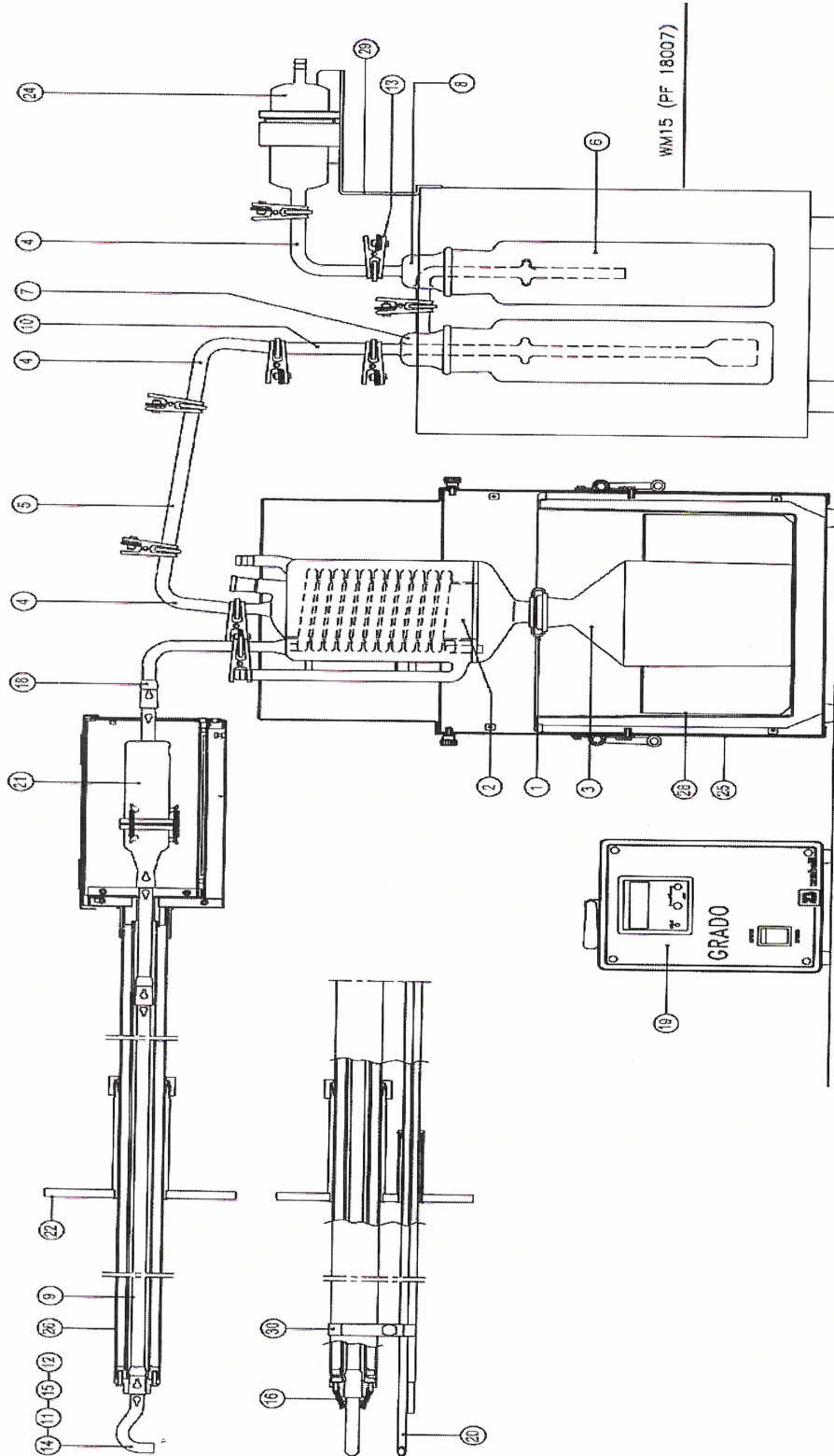
The samples were analysed at the ALS Czech Republic, s.r.o accredited laboratory following the CSN EN 1948-2,3 methodology: The determination of polychlorinated dibenzo-p-dioxine, dibenzofurans in emission samples with the method of isotop dilution using HRGC/HRMS.

The dioxin and furans analyses were conducted at the ALS Czech Republic, s.r.o. Laboratory, specifically accredited for the test by the Český Institut Pro Akreditaci, o.p.s. , Nr L 1163.

**Stage III - development and the results and discussion**

The last stage includes results collection from the previous stages, emission calculation and PCDD/DF concentration as well as comparison to the standards in force.

**Test Report No PW/41/05/23**



- Opis:
- 1. ferrule
  - 2. cooler
  - 5,10. aspiration path - tubes
  - 13. clamp
  - 20. Pitot tube „S” - type
  - 25. cooler casing
  - 3. condensation pot
  - 6-8. scrubbers
  - 16. holding springs
  - 21. filter casing
  - 26. heated probe
  - 4,18. aspiration path - elbows
  - 9. aspiration path - probe tube
  - 17. aspiration controller
  - 22. yoke
  - 28. cooler coil
  - 11,12,14,15. - aspiration endings
  - 19. temperature controller
  - 24. gas dryer
  - 29,30. support



---

**Test Report No PW/41/05/23**

---

**6. MEASUREMENT RESULTS**

**Test Report No PW/41/05/23**

- 1) Plant or unit name: **Combined Heat and Power Plant<sup>1)</sup>**
- 2) Flue gases cleaning unit: **ALSTOM NID flue gas cleaning solution (bag filters, activate carbon, ammonia solution, hydrated lime)<sup>1)</sup>**
- 3) Emission source load during measurements: **~85,0 MW<sup>1)</sup>**
- 4) Fuel type or material mass flow in process: **40% municipal waste, 60% industrial waste: 27,3 t/h<sup>1)</sup>**
- 5) Location of sampling and measurements: **in duct, after flue gases cleaning unit**

Measurement reference number		25-04-01		X	X		
Date of measurement		25.04.2023					
Measurement time range		10:19--16:20					
Scope of test		Unit	Results	Uncertainty +/-	Method		
Meteorological conditions	Atmospheric pressure		hPa	<b>1000,0</b>	X		
	Air temperature		oC	<b>14</b>			
Measurement plane	Diameter		m	<b>2,20</b>			
	Area		m <sup>2</sup>	<b>3,7994</b>			
Stack gas parameters	Temperature		oC	<b>53</b>		X	
	Static pressure		Pa	<b>-46</b>			
	Differential pressure		Pa	<b>178</b>			
	Gas moistness grade X		kg/kg	<b>0,098</b>			
	Average velocity		m/s	<b>14,0</b>			0,9
	Chemical composition	O <sub>2</sub>	%	<b>8,3</b>			0,2
		CO <sub>2</sub>	%	<b>11,2</b>	0,4		PN-ISO 10396:2001
	Wet gas density during testing		kg/m <sup>3</sup>	<b>1,050</b>	X		PN-EN 14790:2017
Gas density in normal conditions		kg/m <sup>3</sup> N	<b>1,269</b>	PN-EN 14790:2017			
Gas density in conventional conditions		kg/m <sup>3</sup> U	<b>1,345</b>	PN-EN 14790:2017			
Concentration in the gas at measurement conditions		PCDDF*	ng/m <sup>3</sup>	<b>0,0014</b>		0,0004	PN-EN 1948:2006
Concentration in the gas at normal conditions		PCDDF*	ng/m <sup>3</sup> N	<b>0,0015</b>	0,0005	PN-EN 1948:2006	
Concentration of the substance in the gas in the standard conditions		PCDDF*	ng/m <sup>3</sup> U	<b>0,0018</b>	0,0006	PN-EN 1948:2006	
Concentration of the substance in the gas in the reference conditions O <sub>2</sub> ref. 11%		PCDDF*	ng/m <sup>3</sup> U	<b>0,0014</b>	0,0004	PN-EN 1948:2006	
Gas volume flow	measurement conditions		m <sup>3</sup> /h	<b>191353</b>	24062	X	
	normal conditions		m <sup>3</sup> N/h	<b>158362</b>	19927		
	conventional conditions		m <sup>3</sup> U/h	<b>135978</b>	17914		
	conventional conditions O <sub>2</sub> ref. 11%		m <sup>3</sup> U/h	<b>172693</b>	23110		
The emission obtained by measuring		PCDDF*	ng/h	<b>244,76</b>	82,96	PN-EN 1948:2006	
Emission limits		PCDDF*	ng/m <sup>3</sup> U	<b>0,1</b>	X	X	
Transgression		PCDDF*	ng/m <sup>3</sup> U	<b>-</b>			

\*- the results obtained from the subcontractor ( accredited )

<sup>1)</sup>-information obtained from the client



**Test Report No PW/41/05/23**Notes:

Normal conditions designate the temperature of 273 K and pressure of 101,3kPa, defining normal cubic meter m<sup>3</sup>N. The conventional conditions designate the temperature of 273K, pressure of 101,3 kPa and dry gases (steam contents less than 5 g/kg of flue gas), defining conventional cubic meter, m<sup>3</sup>U

The specified expanded uncertainty comes from standard uncertainty multiplied by expansion coefficient k = 2, which provides 95% level of confidence for normal distribution. Uncertainty takes into account the sampling and analysis.

Registry of samples delivered to the laboratory: P/203/04/23, P/204/04/23

Date of delivery to the laboratory: 27.04.2023

Date of analysis: 28.04 - 15.05.2023

**Field blanks:**

ID/ number of sample	Type of substance	The criterion of the blank [ng/m <sup>3</sup> ] 11%O <sub>2</sub>	The value of the blank [ng/m <sup>3</sup> ] 11% O <sub>2</sub>	Result [+/-]
P/204/04/23	PCDD/DF	0,01	< 0,0012	+

Work parameters of measurement system:**PCDD/DF (PN-EN 1948:2006):**

sampling method: condensation - adsorption method  
 filter parameters: 19 x 90 mm, filter efficiency: 99,998 %  
 sampling train: 2 measurement axis  
 oxygen reference : 11 %  
 time of dioxins and furans measurement: 10:19 – 16:20 (360,1 min)  
 nozzle diameter: 8 mm  
 probe temperature: 118 °C  
 scrubbers temperature 4 °C  
 aspired gas volume 11,7 m<sup>3</sup>  
 average sampling flow 32,5 l/min  
 isokinetic ratio: 99,5 %  
 leak test: + / +  
 gas meter temperature 18 °C  
 gas meter pressure 0 bar  
 spiking pattern: filter surface  
 absorption solution: 100 ml H<sub>2</sub>O dest. + 50 ml 2-etoksyetanol  
 recovery: 56 % <sup>13</sup>C<sub>12</sub>-1,2,3,7,8-PECDF, />50%/  
 64 % <sup>13</sup>C<sub>12</sub>-1,2,3,7,8,9-HxCDF, />50%/  
 100 % <sup>13</sup>C<sub>12</sub>-1,2,3,7,8,9 HpCDF. />50%/  
 TEQ sample mass: 0,02 ng

**H<sub>2</sub>O (PN-EN 14790:2017)**

sampling train: 2 measurement axis  
 sampling equipment: titanium sampling train  
 heated probe 2,0 m long  
 sampling pump: PT-01  
 cartridge: moisture measurement set  
 number of samplings: 1  
 sampling time: 30 min  
 sampling volume: 2,0 l/min  
 H<sub>2</sub>O mass: 6,5 g  
 absorption efficiency: 98,5 %

**Test Report No PW/41/05/23**

**O<sub>2</sub> paramagnetic (PN-EN 14789:2017):**

Range :                                      0 – 5 % [ ]  
    0 – 10 % [X]  
    0 – 25 % [ ]

Calibration gas:                            O<sub>2</sub> – 9,012%        [X]        R/07/W  
    O<sub>2</sub> – 20,018%      [ ]        R/12/W  
    N<sub>2</sub> – 99,99%       [X]        R/17/

Sampling train:                              2 measurement axis

Sampling time/ average time:            360 min / 1 min

O <sub>2</sub> concentration measurement (paramagnetic):		HORIBA PG-350E-EU (130/1/AW/21)			
check operation		unit	result	criterion	result +/-
„0” after adjustment, without sampling train		%	0,05	± 0,1 [%]*	+
„0” after adjustment, with sampling train	before measurement	%	0,1	± 0,2 [%]**	+
	after measurement	%	0,07	± 0,2 [%]**	+
„Span” after adjustment with sampling train /standard 9,012 % R/07/W analyzer range 25%/	before measurement	%	9,0	± 0,2 [%]**	+
	after measurement	%	8,95	± 0,2 [%]**	+
	before measurement time T90	% sec.	8,2 30	> 8,12 [%] < 200 sec.	----- +



**Test Report No PW/41/05/23****7. MEASUREMENT DEVICES**

Name of measuring device		X1- Apis PLUS
Type of measuring device		Isokinetic sampler S/N 0185
Certificate	Calibration No	94/54/LA/P/2023 G-73/23-46/23 65/1/T/23
Issued by		PLUM Sp. z o.o. KLEOSIN ZAP BESTWINKA LABOSERWIS Sp. z o.o. KATOWICE
Date of issue the certificate of calibration		27.02.2023 r. 23.02.2023 r. 02.03.2023 r.
Expiration date of the certificate of calibration		-

Name of measuring device		HORIBA
Type of measuring device		PG-350E-EU
Certificate	Calibration No	130/1/AW/21
Issued by		Laboserwis Sp. z o.o. Katowice
Date of issue the certificate of calibration		28.05.2021
Expiration date of the certificate of calibration		-

Name of measuring device		Sampler
Type of measuring device		PT-01
Certificate	Calibration No	R-286/16-186/16 G-354/22-208/22 1189/436/LA/T/2022 786/281/LA/P/2022
Issued by		ZAP BESTWINKA PLUM SP. Z O.O. KLEOSIN
Date of issue the certificate of calibration		24.08.2016 30.08.2022 06.09.2022 09.09.2022
Expiration date of the certificate of calibration		-

## Test Report No PW/41/05/23

## 8. ANALYSIS RESULTS

## Attachment no. 1 to the Certificate of Analysis for work order PR2344599

Sample:

P/203/04/23

## Measurement results PCDD/Fs:

Sample:		P/203/04/23		Final extract [µl]:		60	
				Injection volume [µl]:		4	
				Acquisition date [d.m.y h:m]:		8.5.23 2:00	
2,3,7,8-PCDD/Fs	Result [ng/sample]	Limit of Detection [ng/sample]	Limit of Quantification [ng/sample]	<sup>4</sup> I-TEFs	I-TEQ Upperbound [ng/sample]		
2,3,7,8-TCDD	< 0.0019	0.0019	0.0037	1	0.0019		
1,2,3,7,8-PeCDD	< 0.0035	0.0035	0.0071	0.5	0.0018		
1,2,3,4,7,8-HxCDD	< 0.0087	0.0087	0.017	0.1	0.00087		
1,2,3,6,7,8-HxCDD	< 0.0087	0.0087	0.017	0.1	0.00087		
1,2,3,7,8,9-HxCDD	< 0.0087	0.0087	0.017	0.1	0.00087		
1,2,3,4,6,7,8-HpCDD	< 0.025	0.025	0.049	0.01	0.00025		
OCDD	< 0.031	0.015	0.031	0.001	0.000031		
2,3,7,8-TCDF	< 0.017	0.0085	0.017	0.1	0.0017		
1,2,3,7,8-PeCDF	< 0.0062	0.0062	0.012	0.05	0.00031		
2,3,4,7,8-PeCDF	< 0.012	0.0062	0.012	0.5	0.0062		
1,2,3,4,7,8-HxCDF	< 0.014	0.0072	0.014	0.1	0.0014		
1,2,3,6,7,8-HxCDF	< 0.0072	0.0072	0.014	0.1	0.00072		
1,2,3,7,8,9-HxCDF	< 0.0072	0.0072	0.014	0.1	0.00072		
2,3,4,6,7,8-HxCDF	< 0.014	0.0072	0.014	0.1	0.0014		
1,2,3,4,6,7,8-HpCDF	< 0.035	0.017	0.035	0.01	0.00035		
1,2,3,4,7,8,9-HpCDF	< 0.017	0.017	0.035	0.01	0.00017		
OCDF	< 0.027	0.014	0.027	0.001	0.000027		
I-TEQ from quantified 2,3,7,8-PCDD/Fs - "Lowerbound"					0		
I-TEQ from 2,3,7,8-PCDD/Fs - "Mediumbound"					0.0098		
Maximum possible I-TEQ - "Upperbound"					0.02		
PCDDs	Result [ng/sample]	PCDFs	Result [ng/sample]				
Tetra-CDDs	< 0.041	Tetra-CDFs	< 0.32				
Penta-CDDs	< 0.05	Penta-CDFs	< 0.17				
Hexa-CDDs	< 0.087	Hexa-CDFs	< 0.12				
Hepta-CDDs	< 0.049	Hepta-CDFs	< 0.07				
OCDD	< 0.031	OCDF	< 0.027				

<sup>4</sup>I-TEF according to NATO.

Limits of quantification are defined as double of the detection limits.

The limit of detection is defined as the amount of analyte producing a signal with S/N<sub>3</sub>.

The value of the detection limit is mentioned as the actual value at the acquisition date.

Measurement uncertainty is expressed as a double (k=2) relative standard deviation (RSD%), and corresponds to 95% confidence interval.

Estimation of uncertainty of each 2,3,7,8-PCDD/F congener is 30% and total I-TEQ is 20%.

These values were ensured by analyses of certified reference material under conditions of internal reproducibility.

Results marked with "&lt;" are below limit of detection or quantification.

"Lowerbound" and "Upperbound" are levels defined in Regulation 2017/644 and EN 1948-4.

"Mediumbound" is levels defined in Regulation 2017/644.



**Test Report No PW/41/05/23****Attachment no. 1 to the Certificate of Analysis for work order PR2344599**

Sample:

P/203/04/23

**Standards recovery:**

Sample:		P/203/04/23			
		Final extract [ $\mu$ l]:		60	
		Injection volume [ $\mu$ l]:		4	
		Acquisition date [d.m.y h:m]:		8.5.23 2:00	
Extraction standard	Recovery [%]	Acceptable range [%]		Accept. rec. with respect to	
		Basic	Extended	basic range	extended range
<b>PCDDs</b>					
13C12 - 2,3,7,8-TCDD	86	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,7,8-PeCDD	55	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,7,8-HxCDD	100	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,6,7,8-HxCDD	72	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,6,7,8-HpCDD	99	40 - 130	20 - 150	YES	-
13C12 - OCDD	96	40 - 130	20 - 150	YES	-
<b>PCDFs</b>					
13C12 - 2,3,7,8-TCDF	92	50 - 130	30 - 150	YES	-
13C12 - 2,3,4,7,8-PeCDF	60	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,7,8-HxCDF	90	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,6,7,8-HxCDF	120	50 - 130	30 - 150	YES	-
13C12 - 2,3,4,6,7,8-HxCDF	87	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,6,7,8-HpCDF	77	40 - 130	20 - 150	YES	-
13C12 - OCDF	56	40 - 130	20 - 150	YES	-
Sampling standard	Recovery [%]	Acceptable range [%]		Rec. in range?	
13C12-1,2,3,7,8-PeCDF	56	> 50		YES	
13C12-1,2,3,7,8,9-HxCDF	64	> 50		YES	
13C12-1,2,3,4,7,8,9-HpCDF	100	> 50		YES	

**Test Report No PW/41/05/23****9. CERTIFICATE OF ACCREDITATION****POLSKIE CENTRUM AKREDYTACJI**  
POLISH CENTRE FOR ACCREDITATIONSygnatariusz EA MLA  
EA MLA Signatory**CERTYFIKAT AKREDYTACJI**  
**LABORATORIUM BADAWCZEGO**  
ACCREDITATION CERTIFICATE OF TESTING LABORATORY  
**Nr AB 994**

Potwierdza się, że: / This is to confirm that:

**„PROFTECH” Sp. z o.o.**  
ul. Kurta Aldera 44, 41-506 Chorzówspełnia wymagania normy PN-EN ISO/IEC 17025:2018-02  
meets requirements of the PN-EN ISO/IEC 17025:2018-02 standardAkredytowana działalność jest określona w Zakresie Akredytacji Nr AB 994  
Accredited activity is defined in the Scope of Accreditation No AB 994Akredytacja pozostaje w mocy pod warunkiem przestrzegania  
wymagań jednostki akredytującej określonych w kontrakcie Nr AB 994  
This accreditation remains in force provided the Laboratory observes  
the requirements of Accreditation Body defined in the Contract No AB 994Akredytacji udzielono dnia 30.01.2009 r.  
Accreditation was granted on 30.01.2009DYREKTOR  
POLSKIEGO CENTRUM AKREDYTACJI  
LUCYNA OLBORSKA

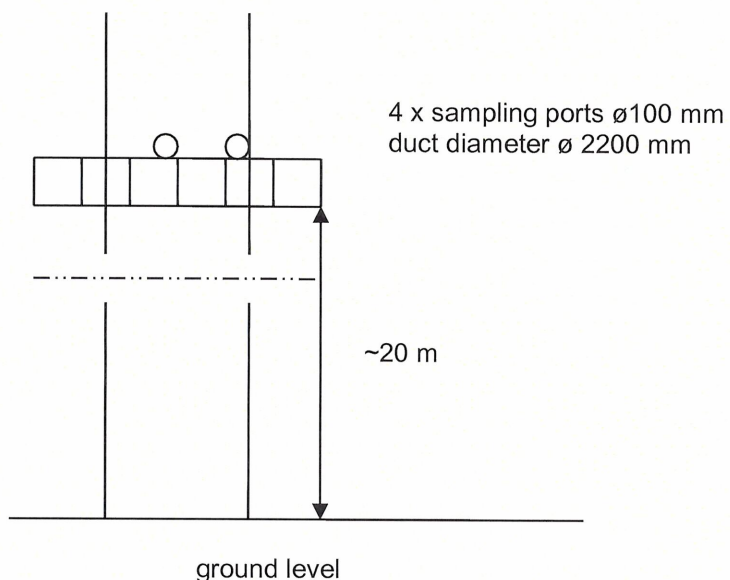
Warszawa, dnia 9 grudnia 2019 roku

---

**Test Report No PW/41/05/23**

---

**10. MEASUREMENT PLANE SCHEME**



Approved by  
DYREKTOR

.....Dariusz Guja.....  
Name and Signature

END OF REPORT



