



**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, October 31<sup>st</sup> 2024  
Our ref. No.: PW/81/10/24

## **Report No PW/81/10/24**

**on concentration measurements of PCDDs/PCDFs 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

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

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**1. PURPOSE AND SCOPE OF THE REPORT**

Purpose of executed measurements was to determine the concentration and emission of *PCDDs/PCDFs and dioxins-like PCBs* 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 dated June 06<sup>th</sup> 2024, our reference number PP/28/06/24.

**3. MEASUREMENT TEAM**

The measurements taken on October 1<sup>st</sup> 2024 were executed by the following team:

- Grzegorz Bortel specialist- measurement team leader,
- 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	0,0045
Emission limits	PCDDF	ng/m3	0,06



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**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-HR 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-HR 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>

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**PCDDs/PCDFs and dioxins-like PCBs 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”.

PCB samples were taken according to the requirements of Polish Standard PN-EN 1948-4:2014-03 „ Stationary source emissions - Determination of mass concentration of PCDDs/PCDFs and dioxin-type PCBs - Part 4: Sampling and analysis dioxin-like PCBs”.

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

**Stage I - sampling**

For the determination of mass concentration of PCDD/DF and PCBs 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 and PCBs sampling system conformed to European Standard PN-EN 1948-1:2006 and PN-EN 1948-4:2014-03.

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

**Stage II - laboratory analysis**

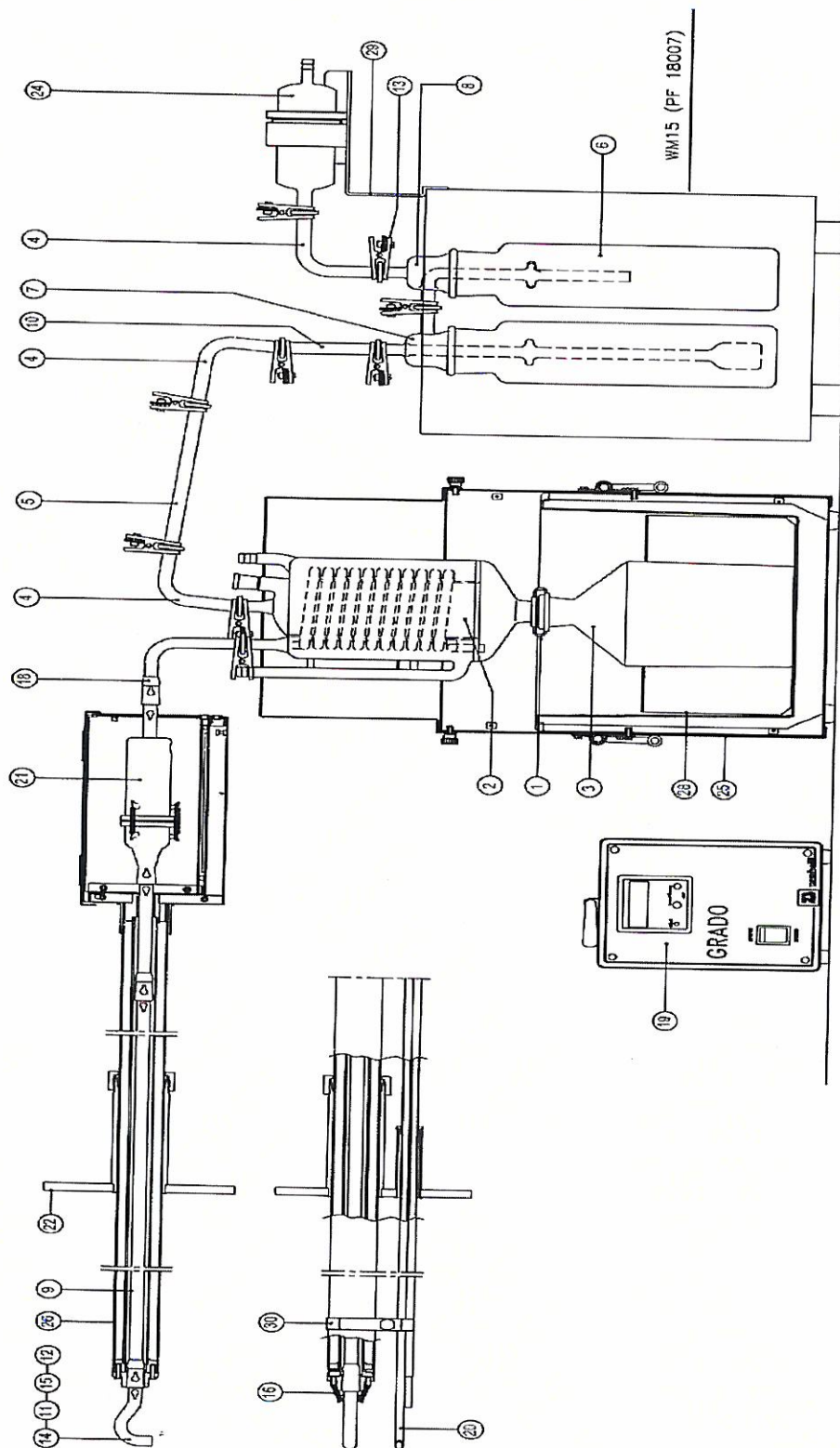
The samples were analysed at the ALS Czech Republic, s.r.o accredited laboratory following the CSN EN 1948-2,3,4 methodology: The determination of polychlorinated dibenzo-p-dioxine, dibenzofurans in emission samples with the method of isotop dillution using HRGC/HRMS.

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 and PCBs concentration as well as comparison to the standards in force.

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- 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                     |  |



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**6. MEASUREMENT RESULTS**

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- 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: **89 MW**  
 4) Fuel type or material mass flow in process: **40% municipal waste, 60% industrial waste; 33 t/h**  
 5) Location of sampling and measurements: **in duct, after flue gases cleaning unit**

Measurement reference number			01-10-02 0185		
Date of measurement			01.10.2024		
Measurement time range			10:32-16:33		
Scope of test		Unit	Results	Uncertainty +/-	Method
Meteorological conditions	Atmospheric pressure		hPa	1016,5	
	Air temperature		oC	8	
Measurement plane	Diameter		m	2,20	
	Area		m <sup>2</sup>	3,7994	
Stack gas parameters	Temperature		oC	55	PN-Z-04030-7:1994
	Static pressure		Pa	10	
	Differential pressure		Pa	127	
	Gas moistness grade X		kg/kg	0,131	
	Average velocity		m/s	12,3	0,8
	Chemical composition	O <sub>2</sub>	%	8,2	0,2
		CO <sub>2</sub>	%	11,7	0,5
	Wet gas density during testing		kg/m <sup>3</sup>	1,043	
	Gas density in normal conditions		kg/m <sup>3</sup> N	1,250	
	Gas density in conventional conditions		kg/m <sup>3</sup> U	1,348	
Concentration in the gas at measurement conditions	PCDDF*		ng/m <sup>3</sup>	0,0045	0,0014
Concentration in the gas at normal conditions	PCDDF*		ng/m <sup>3</sup> N	0,0057	0,0018
Concentration of the substance in the gas in the standard conditions	PCDDF*		ng/m <sup>3</sup> U	0,0058	0,0018
Concentration of the substance in the gas in the reference conditions O <sub>2</sub> ref. 11%	PCDDF*		ng/m <sup>3</sup> U	0,0045	0,0014
Gas volume flow	measurement conditions		m <sup>3</sup> /h	168785	PN-EN ISO 16911-1:2013
	normal conditions		m <sup>3</sup> N/h	140854	
	conventional conditions		m <sup>3</sup> U/h	115482	
	conventional conditions O <sub>2</sub> ref. 11%		m <sup>3</sup> U/h	147817	
The emission obtained by measuring	PCDDF*		ng/h	669,80	225,49
Emission limits	PCDDF*		ng/m <sup>3</sup> U	0,06	
Transgerssion	PCDDF*		ng/m <sup>3</sup> U	-	

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

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



**Test Report No PW/81/10/24**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/55/10/24, P/56/10/24

Date of delivery to the laboratory: 03.10.2024

Date of analysis: 03.10 - 24.10.2024

**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/56/10/24	PCDD/DF	0,006	< 0,0013	+

Work parameters of measurement system:**PCDD/DF (PN-EN 1948:2006) and PCB (PN-EN 1948-4+A1:2013)::**

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:	10:32 – 16:33 (361 min)		
nozzle diameter:	6	mm	
probe temperature:	119	°C	
scrubbers temperature	5	°C	
aspired gas volume	5,225	m <sup>3</sup>	
average sampling flow	14,5	l/min	
izokinetic ratio:	96,6	%	
leak test:	+ / +		
gas meter temperature	13	°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:	77 %	<sup>13</sup> C <sub>12</sub> -1,2,3,7,8-PECDF,	/>50%/
	78 %	<sup>13</sup> C <sub>12</sub> -1,2,3,7,8,9-HxCDF,	/>50%/
	65 %	<sup>13</sup> C <sub>12</sub> -1,2,3,7,8,9 HpCDF.	/>50%/
PCDD/DF TEQ sample mass:	0,029	ng	

**Test Report No PW/81/10/24****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: SKC  
cartridge: moisture measurement set  
number of samplings: 1  
sampling time: 30 min  
sampling volume: 2,0 l/min  
H<sub>2</sub>O maas: 9,4 g  
absrobtion efficiency: 98,5 %

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

Range : 0 – 5 % [ ]  
0 – 10 % [ ]  
0 – 25 % [ X ]  
Calibration gas: O<sub>2</sub> – 8,001% [ ] R/07/W  
O<sub>2</sub> – 18,85% [X] 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-HR			
check operation		unit	result	criterion	result +/-
„0” after adjustment, without sampling train		%	0,04	± 0,1 [%]*	+
„0” after adjustment, with sampling train	before measurement	%	0,10	± 0,2 [%]**	+
	after measurement	%	0,12	± 0,2 [%]**	+
„Span” after adjustment with sampling train /standard 18,85 % R/12/W analyzer range 25%/	before measurement	%	18,80	± 0,2 [%]**	+
	after measurement	%	18,95	± 0,2 [%]**	+
	before measurement	%	17,0	> 17,0 [%]	-----
	time T90	sec.	12	< 200 sec.	+

**Test Report No PW/81/10/24****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-HR
Certificate	Calibration No	69/1/AW/21
Issued by		LABOSERWIS SP. Z O.O. KATOWICE
Date of issue the certificate of calibration		22.03.2021 r.
Expiration date of the certificate of calibration		-

Name of measuring device		Sampler
Type of measuring device		SKC 224-PCMTX4, 224-44MTX
Certificate	Calibration No	n.d.
Issued by		n.d.
Date of issue the certificate of calibration		n.d.
Expiration date of the certificate of calibration		-

Name of measuring device		SKC SAMPLER KIT
Type of measuring device		-
Certificate	Calibration No	T271/PMT/2021 212/1/C/21
Issued by		CZACH-POMIAR Sp. z o.o. KATOWICE LABOSERWIS Sp. z o.o. KATOWICE
Date of issue the certificate of calibration		21.09.2021 01.09.2021
Expiration date of the certificate of calibration		-



**Test Report No PW/81/10/24****8. ANALYSIS RESULTS***Attachment no. 1 to the Certificate of Analysis for work order PR24C3610*

Sample:

P/55/10/24

ALS SAMPLE ID: PR24C3610/ 001

Measurement results PCDD/Fs:

Sample: P/55/10/24		Final extract [µl]: 60			
		Injection volume [µl]: 4			
		Acquisition date [d.m.y h.m]: 20.10.24 1:26			
2,3,7,8-PCDD/Fs	Result [ng/sample]	Limit of Detection [ng/sample]	Limit of Quantification [ng/sample]	I-TEFs	I-TEQ Upperbound [ng/sample]
2,3,7,8-TCDD	< 0.005	0.005	0.01	1	0.005
1,2,3,7,8-PeCDD	< 0.0067	0.0067	0.013	0.5	0.0034
1,2,3,4,7,8-HxCDD	< 0.0069	0.0069	0.014	0.1	0.00069
1,2,3,6,7,8-HxCDD	0.032	0.0069	0.014	0.1	0.0032
1,2,3,7,8,9-HxCDD	< 0.0069	0.0069	0.014	0.1	0.00069
1,2,3,4,6,7,8-HpCDD	0.4	0.018	0.036	0.01	0.004
OCDD	1.1	0.04	0.08	0.001	0.0011
2,3,7,8-TCDF	0.015	0.0051	0.01	0.1	0.0015
1,2,3,7,8-PeCDF	0.0084	0.0041	0.0083	0.05	0.00042
2,3,4,7,8-PeCDF	0.013	0.0041	0.0083	0.5	0.0063
1,2,3,4,7,8-HxCDF	0.0089	0.00061	0.0012	0.1	0.00089
1,2,3,6,7,8-HxCDF	0.0088	0.00061	0.0012	0.1	0.00088
1,2,3,7,8,9-HxCDF	< 0.00061	0.00061	0.0012	0.1	0.000061
2,3,4,6,7,8-HxCDF	0.009	0.00061	0.0012	0.1	0.0009
1,2,3,4,6,7,8-HpCDF	0.015	0.0071	0.014	0.01	0.00015
1,2,3,4,7,8,9-HpCDF	< 0.0071	0.0071	0.014	0.01	0.000071
OCDF	0.032	0.011	0.023	0.001	0.000032
I-TEQ from quantified 2,3,7,8-PCDD/Fs - "Lowerbound"					0.019
I-TEQ from 2,3,7,8-PCDD/Fs - "Mediumbound"					0.024
Maximum possible I-TEQ - "Upperbound"					0.029
PCDDs	Result [ng/sample]	PCDFs	Result [ng/sample]		
Tetra-CDDs	< 0.11	Tetra-CDFs	0.55		
Penta-CDDs	0.29	Penta-CDFs	0.43		
Hexa-CDDs	0.43	Hexa-CDFs	0.095		
Hepta-CDDs	0.8	Hepta-CDFs	0.049		
OCDD	1.1	OCDF	0.032		

<sup>1</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&gt;3.

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/81/10/24****Attachment no. 1 to the Certificate of Analysis for work order PR24C3610**

Sample:

P/55/10/24

Standards recovery:

Sample:		P/55/10/24			
		Final extract [µl]:		60	
		Injection volume [µl]:		4	
		Acquisition date [d.m.y h:m]:		20.10.24 1:26	
Extraction standard	Recovery [%]	Acceptable range [%]		Accept. rec. with respect to	
PCDDs		Basic	Extended	basic range	extended range
13C12 - 2,3,7,8-TCDD	85	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,7,8-PeCDD	61	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,7,8-HxCDD	81	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,6,7,8-HxCDD	82	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,6,7,8-HpCDD	87	40 - 130	20 - 150	YES	-
13C12 - OCDD	76	40 - 130	20 - 150	YES	-
PCDFs					
13C12 - 2,3,7,8-TCDF	75	50 - 130	30 - 150	YES	-
13C12 - 2,3,4,7,8-PeCDF	65	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,7,8-HxCDF	82	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,6,7,8-HxCDF	87	50 - 130	30 - 150	YES	-
13C12 - 2,3,4,6,7,8-HxCDF	86	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,6,7,8-HpCDF	79	40 - 130	20 - 150	YES	-
13C12 - OCDF	92	40 - 130	20 - 150	YES	-
Sampling standard	Recovery [%]	Acceptable range [%]		Rec. in range?	
13C12-1,2,3,7,8-PeCDF	77	> 50		YES	
13C12-1,2,3,7,8,9-HxCDF	78	> 50		YES	
13C12-1,2,3,4,7,8,9-HpCDF	65	> 50		YES	



**Test Report No PW/81/10/24****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 Chorzów**spełnia 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 OLSBORSKA

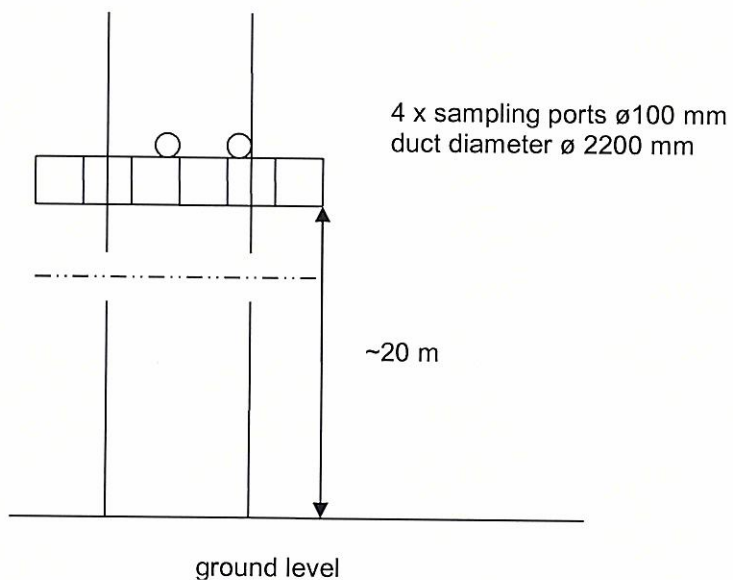
Warszawa, dnia 9 grudnia 2019 roku



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**10. MEASUREMENT PLANE SCHEME**

Approved by

DYREKTOR

Name and Signature  
Dariusz Guja

END OF REPORT

