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AB 994

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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; Tl; 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, December 12<sup>th</sup> 2023  
Our ref. No.: PW/25/12/23

**Report No PW/25/12/23**

**on concentration measurements of dioxins, furans, heavy metals (As; Cd; Cr; Co; Cu; Mn; Ni; Pb; Sb; Tl; V and Hg) emitted into environment from stationary emission source No. 001 (waste incineration boiler stack), located at UAB Vilniaus Kogeneracinė Jėgainė, Jočionių g. 13, 02300 Vilnius**

Client name and address:

**UAB Vilniaus Kogeneracinė Jėgainė**  
Žvejų St. 14,  
LT-09310 Vilnius

Developed by:

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

Purpose of executed measurements was to determine the concentration of dioxins, furans, heavy metals (As; Cd; Cr; Co; Cu; Mn; Ni; Pb; Sb; Tl; V and Hg) emitted to environment from stationary emission source No. 001 (waste incineration boiler stack), located at UAB Vilniaus Kogeneracinė Jėgainė, Jočionių g. 13, 02300 Vilnius

*Measurements range:*

- PCDD/DF concentration,
- Heavy metals (As; Cd; Cr; Co; Cu; Mn; Ni; Pb; Sb; Tl; V and Hg) concentration,

The measurements were carried out in accordance with the sampling plan dated 07.11.2023 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 contract No VKJ\_S\_2020-263 dated December 16<sup>th</sup> 2020.

**3. MEASUREMENT TEAM**

The measurements taken on November 7<sup>th</sup> 2023 were executed by the following team:

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

**Test Report No PW/25/12/23****4. MEASUREMENT RESULTS SUMMARY**

Below are presented measurement results summary, full measurement results are presented in chapter No 6, at page 9, 12 and 13.

Stationary emission source No. 001 (waste incineration boiler stack)	Concentration of the substance in the gas in the reference conditions O <sub>2</sub> ref. 11%	PCDDF*	ng/m <sup>3</sup> ref.	<b>0,0030</b>
	Emission limits	PCDDF	ng/m <sup>3</sup> ref.	<b>0,10</b>
	Transgresssion	PCDDF	ng/m <sup>3</sup> ref.	-
	Concentration of the substance in the gas in the reference conditions O <sub>2</sub> ref. 11%	Cd*+Tl*	mg/m <sup>3</sup> ref.	<b>0,007</b>
		Hg*	mg/m <sup>3</sup> ref.	<b>&lt;0,000039</b>
		Sb*+As*+Cr*+Co*+Mn*+Cu*+Ni*+Pb*+V*	mg/m <sup>3</sup> ref.	<b>0,037</b>
	Emission limits	Cd+Tl	mg/m <sup>3</sup> ref.	<b>0,05</b>
		Hg	mg/m <sup>3</sup> ref.	<b>0,05</b>
		Sb+As+Cr+Co+Mn+Cu+Ni+Pb+V	mg/m <sup>3</sup> ref.	<b>0,50</b>
	Transgresssion	Cd+Tl	mg/m <sup>3</sup> ref.	-
		Hg	mg/m <sup>3</sup> ref.	-
		Sb+As+Cr+Co+Mn+Cu+Ni+Pb+V	mg/m <sup>3</sup> ref.	-

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

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

The flow rate and density of flue gases were determined according to Polish Standard PN-Z-04030-7:1994 „Testing of particulate content. The gravimetric method measurement of concentration and particulate mass flow in flue gases" Gravimetric dust monitor type MEGASYSTEM X-1 APIS and type "S" Pitot tube were used for the measurements. Measurement is accredited.

Accreditation range: differential pressure: > 10 Pa

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

The concentration of O<sub>2</sub> was determined using gas analyzers HORIBA PG-350E-HR and HORIBA PG-350E-EU equipped with testing probes 1750 mm long. The measurements were taken according to the procedure described in measurement unit as well as to EN 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 analyzers HORIBA PG-350E-HR and HORIBA PG-350E-EU equipped with testing probes 1750 mm long. The measurements were taken according to the procedure described in measurement unit as well as to ISO 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 of heavy metals content**

Sampling for the determination of concentrations and emissions of heavy metals ( Cd, Tl, Sb , As, Cr, Co, Cu , Mn , Ni , Pb, V ) was performed according to PN -EN 14385 : 2005. Analysis of metals (Cd , Tl , Sb , As, Cr, Co, Cu , Mn , Ni , Pb, V) was performed in the laboratory of ŚCOP Sp. z o.o. in Czeladź , accredited in this regard by the Polish Centre of Accreditation No. AB 719

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**Measurement of mercury (Hg) content**

Sampling for the determination of concentrations and emissions of mercury (Hg) was made according to PN -EN 13211 + AC : 2006. Analysis of mercury (Hg) was made in a laboratory of ŚCOP Sp. z o.o. in Czeladź , accredited in this regard by the Polish Centre of Accreditation No. AB 719

**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 conformed to European Standard PN-EN 1948-1:2006.

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

**Stage II - laboratory analysis**

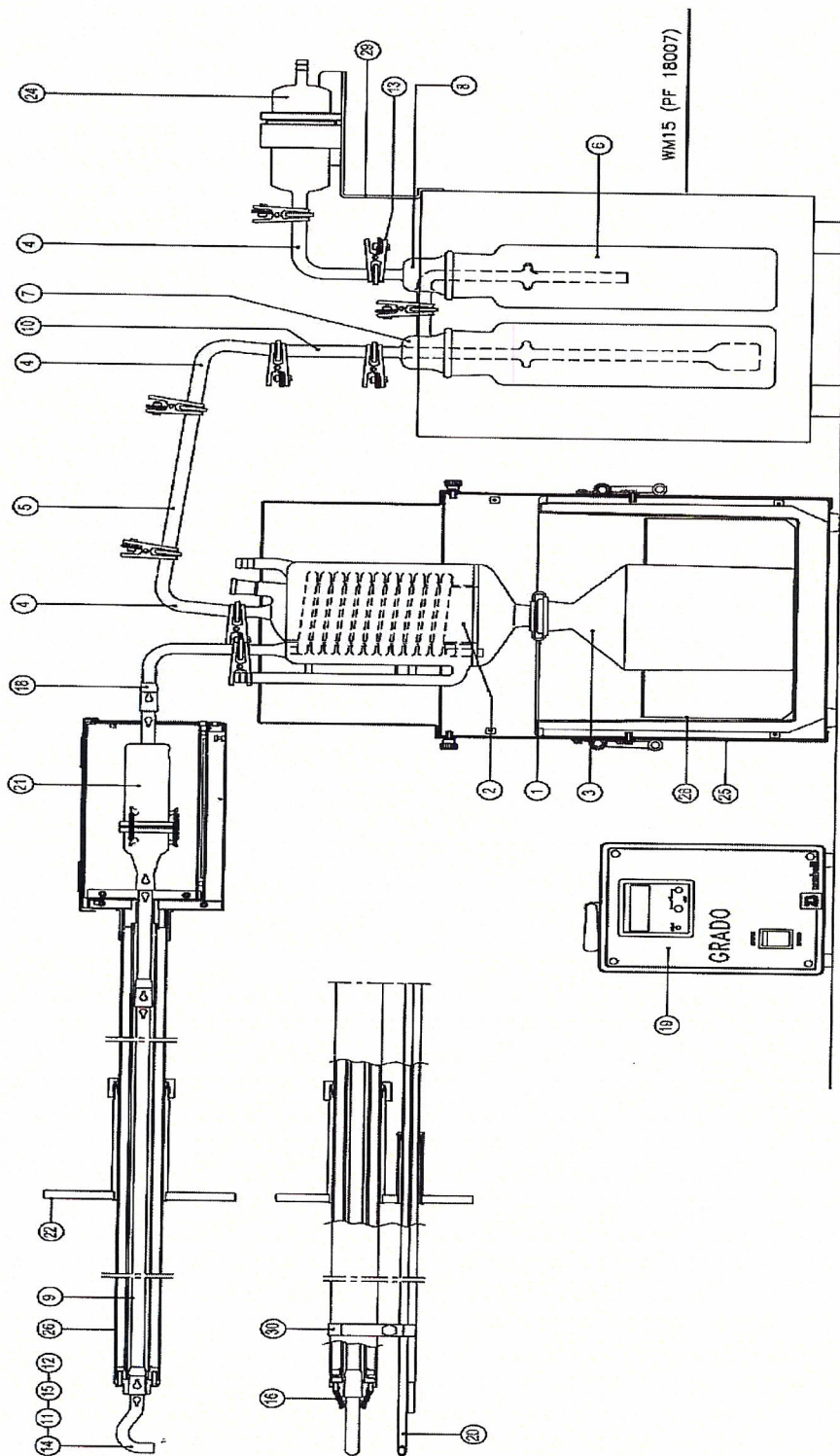
The samples were analysed at the ALS Czech Republic, s.r.o accredited laboratory following the CSN EN 1948-2,3 methodology: The determination of polychlorinated dibenzo-p-dioxine, dibenzofurans in emission samples with the method of isotop dillution using HRGC/HRMS.

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. , No L1163.

**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.

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

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**6. MEASUREMENT RESULTS**

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- 1) Plant or unit name<sup>1)</sup>: **Stationary emission source No. 001 (waste incineration boiler stack)**
- 2) Flue gases cleaning unit<sup>1)</sup>: **Evaporative cooler, hydrated lime and active carbon reactor, bag filters unit (2x4)**
- 3) Emission source load during measurements<sup>1)</sup>: **Boiler load: no data**
- 4) Fuel type or material mass flow in process<sup>1)</sup>: **Waste ~27,1 t/h**
- 5) Location of sampling and measurements: **in duct, after flue gases cleaning unit**

Measurement reference number		07-11-01		X	X	
Date of measurement		07.11.2023				
Measurement time range		10:50-16:51				
Scope of test		Unit	Results	Uncertainty +/-	Method	
Meteorological conditions	Atmospheric pressure	hPa	991,4	X	PN-Z-04030-7:1994	
	Ambient temperature	oC	9			
Measurement plane	Diameter	m	2,10			
	Area	m2	3,4619			
The parameters of gas in line	Temperature	oC	32		0,1	PN-EN 14790:2017
	Static pressure	Pa	-57			PN-Z-04030-7:1994
	Differential pressure	Pa	95		0,2	PN-EN 14789:2017
	Gas moistness grade X	kg/kg	0,043			PN-ISO 10396:2001
	Average velocity	m/s	9,8		X	PN-EN 14790:2017
	Chemical composition	O2	%			7,2
		CO2	%	11,8		PN-ISO 10396:2001
	Wet gas density during testing	kg/m3	1,147	PN-EN 14790:2017		
Gas density in normal conditions	kg/m3 N	1,311	PN-EN 14790:2017			
Gas density in conventional conditions	kg/m3 U	1,347	PN-EN 14790:2017			
Concentration of the substance in the gas in reference conditions O2 ref. 11%	PCDDF*	ng/m3 ref.	0,0030	0,0009	PN-EN 1948:2006	
Gas volume flow	measurement conditions	m3/h	122136	2047	PN-Z-04030-7:1994	
	normal conditions	m3N/h	106861	1863		
	standard conditions	m3U/h	99616	4255		
	reference conditions O2 ref. 11%	m3ref./h	137470	6412		
Emission limits	PCDDF*	ng/m3 U	0,10	X	X	
Transgerssion	PCDDF*	ng/m3 U	-			

\*- the results obtained from the subcontractor ( accredited )  
<sup>1)</sup>-information obtained from the client

**Test Report No PW/25/12/23****Notes:**

Normal conditions designate the temperature of 273 K and pressure of 101,3kPa, defining normal cubic meter m<sup>3</sup>N. The standard 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 standard 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/83/11/23, P/84/11/23

**Date of delivery to the laboratory:** 10.11.2023

**Date of analysis:** 10.11.2023 - 04.12.2023

**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/84/11/23	PCDD/DF	0,01	0,0026	+

**PCDD/DF (PN-EN 1948:2006):**

sampling method:	condensation - adsorption method		
filter parameters:	19 x 90 mm, filter efficiency: 99,998 %		
sampling plane:	2 measurement axis		
oxygen reference :	11 %		
time of dioxins and furans measurement:	10:50 – 16:51 (360,1 min)		
nozzle diameter:	6	mm	
probe temperature:	119	°C	
scrubbers temperature	4	°C	
aspired gas volume	5,04	m <sup>3</sup>	
average sampling flow	14,0	l/min	
isokinetic ratio:	95,1	%	
leak test:	+ / +		
gas meter temperature	15	°C	
gas meter pressure	0	bar	
spiking pattern:	filter surface		
absorption solution:	100 ml H <sub>2</sub> O dest. + 50 ml 2-etoksjetanol		
recovery:	90 %	<sup>13</sup> C <sub>12</sub> -2,3,4,7,8-PECDF,	/>50%/
	84 %	<sup>13</sup> C <sub>12</sub> -1,2,3,6,7,8-HxCDF,	/>50%/
	62 %	<sup>13</sup> C <sub>12</sub> -1,2,3,4,6,7,8 HpCDF.	/>50%/
TEQ sample mass:	0,019	ng	

**Test Report No PW/25/12/23**

- 1) Plant or unit name<sup>1)</sup>: **Stationary emission source No. 001 (waste incineration boiler stack)**
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- 3) Emission source load during measurements<sup>1)</sup>: **Boiler load: no data**
- 4) Fuel type or material mass flow in process<sup>1)</sup>: **Waste ~27,1 t/h**
- 5) Location of sampling and measurements: **in duct, after flue gases cleaning unit**

Measurement reference number		07-11-01		X	X	X		
Date of measurement		07.11.2023						
Measurement time range		11:27-12:03	12:08-12:44					
Scope of test		Unit	Results		Average	Uncertainty +/-	Method	
Meteorological conditions	Atmospheric pressure	hPa	991,9	991,7	<b>991,8</b>		PN-Z-04030-7:1994	
	Air temperature	oC	10	10	<b>10</b>			
Measurement plane	Diameter	m	2,10					
	Area	m2	3,4619					
Stack gas parameters	Temperature	oC	32,9	33,2	<b>33,1</b>			
	Static pressure	Pa	-74,2	-67,3	<b>-70,8</b>			
	Dynamic pressure	Pa	128,4	114,3	<b>121,4</b>			
	Gas moistness grade X	kg/kg	0,043	0,044	<b>0,043</b>			PN-EN 14790:2017
	Average velocity	m/s	11,8	11,2	<b>11,5</b>	0,2		PN-Z-04030-7:1994
	Chemical composition	O2	%	7,20	7,20	<b>7,20</b>		0,19
		CO2	%	11,70	11,80	<b>11,75</b>	0,45	PN-ISO 10396:2001
	Wet gas density during testing	kg/m3	1,144	1,143	<b>1,143</b>		PN-Z-04030-7:1994	
	Gas density in normal conditions	kg/m3 N	1,310	1,310	<b>1,310</b>		PN-Z-04030-7:1994	
Gas density in standard conditions	kg/m3 U	1,347	1,347	<b>1,347</b>		PN-Z-04030-7:1994		
Concentration of the substance in the gas in reference conditions O2 ref. 11%	As gaseus*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,005099	< 0,005691	< <b>0,005395</b>	0,001144	PN-EN 14385:2005	
	As dust*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,000673	< 0,000691	< <b>0,000682</b>	0,000146	PN-EN 14385:2005	
	As*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,005772	< 0,006382	< <b>0,006077</b>	0,001153	PN-EN 14385:2005	
	Sb gaseus*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,005099	< 0,005691	< <b>0,005395</b>	0,001144	PN-EN 14385:2005	
	Sb dust*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,000673	< 0,000691	< <b>0,000682</b>	0,000146	PN-EN 14385:2005	
	Sb*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,005772	< 0,006382	< <b>0,006077</b>	0,001153	PN-EN 14385:2005	
	Cd gaseus*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,001020	< 0,001138	< <b>0,001079</b>	0,000132	PN-EN 14385:2005	
	Cd dust*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,000135	< 0,000138	< <b>0,000137</b>	0,000017	PN-EN 14385:2005	
	Cd*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,001155	< 0,001276	< <b>0,001216</b>	0,000133	PN-EN 14385:2005	
	Co gaseus*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,002549	< 0,002846	< <b>0,002698</b>	0,000330	PN-EN 14385:2005	
	Co dust*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,000336	< 0,000345	< <b>0,000341</b>	0,000042	PN-EN 14385:2005	
	Co*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,002885	< 0,003191	< <b>0,003038</b>	0,000333	PN-EN 14385:2005	
	Mn gaseus*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,000510	< 0,000569	< <b>0,000540</b>	0,000219	PN-EN 14385:2005	
	Mn dust*	mg/m <sup>3</sup> <sub>ref</sub>	0,000551	0,000338	<b>0,000445</b>	0,000058	PN-EN 14385:2005	
	Mn*	mg/m <sup>3</sup> <sub>ref</sub>	0,001061	0,000907	<b>0,000984</b>	0,000227	PN-EN 14385:2005	
	Cu gaseus*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,002549	< 0,002846	< <b>0,002698</b>	0,000375	PN-EN 14385:2005	
	Cu dust*	mg/m <sup>3</sup> <sub>ref</sub>	0,000841	0,000912	<b>0,000877</b>	0,000119	PN-EN 14385:2005	
	Cu*	mg/m <sup>3</sup> <sub>ref</sub>	0,003390	0,003758	<b>0,003574</b>	0,000393	PN-EN 14385:2005	
	Ni gaseus*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,002549	< 0,002846	< <b>0,002698</b>	0,000375	PN-EN 14385:2005	
	Ni dust*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,000336	< 0,000345	< <b>0,000341</b>	0,000048	PN-EN 14385:2005	
	Ni*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,002885	< 0,003191	< <b>0,003038</b>	0,000378	PN-EN 14385:2005	
	Pb gaseus*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,002549	< 0,002846	< <b>0,002698</b>	0,000623	PN-EN 14385:2005	
	Pb dust*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,000336	< 0,000345	< <b>0,000341</b>	0,000079	PN-EN 14385:2005	
	Pb*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,002885	< 0,003191	< <b>0,003038</b>	0,000628	PN-EN 14385:2005	

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	V gaseus*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,005099	< 0,005691	< <b>0,005395</b>	0,001144	PN-EN 14385:2005
	V dust*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,000673	< 0,000691	< <b>0,000682</b>	0,000146	PN-EN 14385:2005
	V*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,005772	< 0,006382	< <b>0,006077</b>	0,001153	PN-EN 14385:2005
	Cr gaseus*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,004079	< 0,004553	< <b>0,004316</b>	0,000864	PN-EN 14385:2005
	Cr dust*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,000538	< 0,000552	< <b>0,000545</b>	0,000110	PN-EN 14385:2005
	Cr*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,004617	< 0,005105	< <b>0,004861</b>	0,000871	PN-EN 14385:2005
	Tl gaseus*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,005099	< 0,005691	< <b>0,005395</b>	0,001662	PN-EN 14385:2005
	Tl dust*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,000673	< 0,000691	< <b>0,000682</b>	0,000211	PN-EN 14385:2005
	Tl*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,005772	< 0,006382	< <b>0,006077</b>	0,001675	PN-EN 14385:2005
Gas volume flow	measurement conditions	m <sup>3</sup> /h	147560	139210	<b>143385</b>	2403	PN-Z-04030-7:1994
	normal conditions	m <sup>3</sup> <sub>N</sub> /h	128852	121424	<b>125138</b>	2181	
	standard conditions	m <sup>3</sup> <sub>U</sub> /h	120177	113138	<b>116657</b>	4983	
	reference conditions O2 ref. 11%	m <sup>3</sup> <sub>ref</sub> /h	165844	156131	<b>160987</b>	7508	
Emission limits	Cd*+Tl*	mg/m <sup>3</sup> <sub>ref</sub>	0,05				
	Sb*+As*+Cr*+Co*+Mn*+Cu*+Ni*+Pb*+V*	mg/m <sup>3</sup> <sub>ref</sub>	0,50				
Concentration of the substance in the gas in reference conditions O2 ref. 11%	Cd*+Tl*	mg/m <sup>3</sup> <sub>ref</sub>	0,007				
	Sb*+As*+Cr*+Co*+Mn*+Cu*+Ni*+Pb*+V*	mg/m <sup>3</sup> <sub>ref</sub>	0,037				

\*- the results obtained from the subcontractor ( accredited )  
<sup>1)</sup>-information obtained from the client

The notation "< or > y" where y=the value of the mesurand corresponding to the lower/upper limit of the measurement range of the method) means - a test result/result below or above the measurement range of the method. The lower/upper limit of the method's measurement range is assumed for the calculation, respectively. The expanded uncertainty shown is the measurement uncertainty for the value of the lower/upper limit of the measurement range of the method. In the case of converted test results/results obtained from a third-party provider of laboratory services, the measurement range limit of that provider's method is assumed for the calculation.

The measurement range limit for: Cr<0,80 ug / As<1,00 ug/ Cd<0,20 ug / Co<0,50 ug/ Mn<0,10 ug/ Cu<0,50 ug/ Ni<0,50 ug/ Pb<0,50 ug/ Tl<1,00 ug/ V<0,10 ug/ Sb<1,00 ug

**Notes:**

Normal conditions designate the temperature of 273 K and pressure of 101,3kPa, defining normal cubic meter m<sup>3</sup>N. The standard 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 standard 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/85/11/23, P/86/11/23, P/87/11/23, P/88/11/23, P/89/11/23, P/90/11/23, P/91/11/23,

**Date of delivery to the laboratory:** 10.11.2023

**Date of analysis:** 10.11.2023 - 21.11.2023

**Field blanks:**

ID/ number of sample	Type of substance	The criterion of the blank [mg/m <sup>3</sup> ] 11%O <sub>2</sub>	The value of the blank [mg/m <sup>3</sup> ] 11% O <sub>2</sub>	Result [+/-]
P/89/11/23	Cd+Tl	0,005	p.o.	+
P/89/11/23	Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V	0,05	p.o.	+

p.o. – below the limit of quantification.

**Test Report No PW/25/12/23**

- 1) Plant or unit name<sup>1)</sup>: **Stationary emission source No. 001 (waste incineration boiler stack)**
- 2) Flue gases cleaning unit<sup>1)</sup>: **Evaporative cooler, hydrated lime and active carbon reactor, bag filters unit (2x4)**
- 3) Emission source load during measurements<sup>1)</sup>: **Boiler load: no data**
- 4) Fuel type or material mass flow in process<sup>1)</sup>: **Waste ~27,1 t/h**
- 5) Location of sampling and measurements: **in duct, after flue gases cleaning unit**

Measurement reference number			07-11-01		X	X	X	
Date of measurement			07.11.2023					
Measurement time range			12:53-13:29	13:38-14:14				
Scope of test		Unit	Results		Average	Uncertainty +/-	Method	
Meteorological conditions	Atmospheric pressure	hPa	991,6	991,7	<b>991,7</b>		PN-Z-04030-7:1994	
	Air temperature	oC	10	10	<b>10</b>			
Measurement plane	Diameter	m	2,10					
	Area	m2	3,4619					
Stack gas parameters	Temperature	oC	33,2	33,8	<b>33,5</b>			
	Static pressure	Pa	-63,6	-62,1	<b>-62,9</b>			
	Dynamic pressure	Pa	109,7	114,7	<b>112,2</b>			
	Gas moistness grade X	kg/kg	0,038	0,039	<b>0,038</b>			PN-EN 14790:2017
	Average velocity	m/s	10,9	11,2	<b>11,1</b>	0,2		PN-Z-04030-7:1994
	Chemical composition	O2	%	7,20	7,10	<b>7,15</b>		0,18
		CO2	%	11,80	11,90	<b>11,85</b>	0,45	PN-ISO 10396:2001
	Wet gas density during testing	kg/m3	1,147	1,144	<b>1,146</b>		PN-Z-04030-7:1994	
	Gas density in normal conditions	kg/m3 N	1,315	1,315	<b>1,315</b>		PN-Z-04030-7:1994	
Gas density in standard conditions	kg/m3 U	1,347	1,348	<b>1,348</b>		PN-Z-04030-7:1994		
Concentration of the substance in the gas in reference conditions O2 ref. 11%	Hg gaseus*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,000035	< 0,000035	< <b>0,000035</b>	0,000009	PN-EN 13211+AC:2006	
	Hg dust*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,000004	< 0,000004	< <b>0,000004</b>	0,000001	PN-EN 13211+AC:2006	
	Hg*	mg/m <sup>3</sup> <sub>ref</sub>	< 0,000039	< 0,000039	< <b>0,000039</b>	0,000009	PN-EN 13211+AC:2006	
Gas volume flow	measurement conditions	m <sup>3</sup> /h	136219	139459	<b>137839</b>	2310	PN-Z-04030-7:1994	
	normal conditions	m <sup>3</sup> <sub>n</sub> /h	118808	121402	<b>120105</b>	2094		
	standard conditions	m <sup>3</sup> <sub>s</sub> /h	111784	113952	<b>112868</b>	4821		
	reference conditions O2 ref. 11%	m <sup>3</sup> <sub>ref</sub> /h	154262	158393	<b>156328</b>	7287		
Emission limits	Hg*	mg/m <sup>3</sup> <sub>ref</sub>	0,05					
Concentration of the substance in the gas in reference conditions O2 ref. 11%	Hg*	mg/m <sup>3</sup> <sub>ref</sub>	< <b>0,000039</b>					

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

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

The notation "< or > y" where y=the value of the mesurand corresponding to the lower/upper limit of the measurement range of the method) means - a test result/result below or above the measurement range of the method. The lower/upper limit of the method's measurement range is assumed for the calculation, respectively. The expanded uncertainty shown is the measurement uncertainty for the value of the lower/upper limit of the measurement range of the method. In the case of converted test results/results obtained from a third-party provider of laboratory services, the measurement range limit of that provider's method is assumed for the calculation. The measurement range limit for: Hg<0,005 ug

**Test Report No PW/25/12/23**Notes:

Normal conditions designate the temperature of 273 K and pressure of 101,3kPa, defining normal cubic meter m<sup>3</sup>N. The standard 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 standard 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/92/11/23, P/93/11/23, P/94/11/23, P/95/11/23, P/96/11/23

**Date of delivery to the laboratory:** 10.11.2023

**Date of analysis:** 10.11.2023 -21.11.2023

**Field blanks:**

ID/ number of sample	Type of substance	The criterion of the blank [mg/m <sup>3</sup> ] 11%O <sub>2</sub>	The value of the blank [mg/m <sup>3</sup> ] 11% O <sub>2</sub>	Result [+/-]
P/94/11/23	Hg	0,005	p.o.	+

p.o. – below the limit of quantification.

Work parameters of measurement system:**Heavy metals (PN-EN 14385:2005)**

Sampling plane: 2 measurement axis  
 Sampling: isokinetic [x]  
                   nonisokinetic [ ]  
 Isokinetic ratio: 102,2 / 106,0 %  
 Sampling time: 36,1 / 36,0 min  
 Sampled volume: 0,115 / 0,103 m<sup>3</sup>  
 Filter parameters: FT-50: Ø 0,50 mm, efficiency: 99,990 %, quartz (QMA)  
 Impingers: impingers set No. 1 (absorption efficiency 98,5 %)  
 Absorption solution: HNO<sub>3</sub>/H<sub>2</sub>O<sub>2</sub>

**Hg (PN-EN 13211 + AC:2006)**

Sampling plane: 2 measurement axis  
 Sampling: isokinetic [x]  
                   nonisokinetic [ ]  
 Isokinetic ratio: 95,2 % / 96,4 %  
 Sampling time: 36,1 min / 36,1 min  
 Sampled volume: 0,085 m<sup>3</sup> / 0,084 m<sup>3</sup>  
 Impingers: impingers set No. 3 (absorption efficiency 97,2 %)  
 Absorption solution: No. I (manganese (VII) potassium / sulfuric acid (VI))



**Test Report No PW/25/12/23****7. MEASUREMENT DEVICES**

Name of measuring device		X1- Apis
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		ZAP BESTWINKA LABOSERWIS SP. Z O.O. KATOWICE PLUM SP. Z O.O. KLEOSIN
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	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		30.08.2022 06.09.2022 09.09.2022
Expiration date of the certificate of calibration		-

Name of measuring device		X1- Apis
Type of measuring device		Isokinetic sampler S/N 0142
Certificate	Calibration No	G-355/22-208/22 239/1/T/22 818/302/LA/P/2022
Issued by		PLUM Sp. z o.o. KLEOSIN CZAH-POMIAR Sp. z o.o. KATOWICE ZAP J.FIRGANEK BESTWINKA
Date of issue the certificate of calibration		29.08.2022 14.09.2022 22.09.2022
Expiration date of the certificate of calibration		-

**Test Report No PW/25/12/23****8. 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/25/12/23

## 9. DIOXINS AND FURANS ANALYSIS RESULTS

## Attachment no. 1 to the Certificate of Analysis for work order PR23D1882

Sample:

P/83/11/23

## Measurement results PCDD/Fs:

Sample:		P/83/11/23		Final extract [ $\mu$ l]:		60		
				Injection volume [ $\mu$ l]:		4		
				Acquisition date [d.m.y h:m]:		1.12.23 18:18		
2,3,7,8-PCDD/Fs	Result [ng/sample]	Limit of Detection [ng/sample]	Limit of Quantification [ng/sample]	<sup>1</sup> I-TEFs	I-TEQ Upperbound [ng/sample]			
2,3,7,8-TCDD	< 0.0052	0.0052	0.01	1	0.0052			
1,2,3,7,8-PeCDD	< 0.0077	0.0077	0.015	0.5	0.0038			
1,2,3,4,7,8-HxCDD	< 0.0085	0.0085	0.017	0.1	0.00085			
1,2,3,6,7,8-HxCDD	< 0.0085	0.0085	0.017	0.1	0.00085			
1,2,3,7,8,9-HxCDD	< 0.0085	0.0085	0.017	0.1	0.00085			
1,2,3,4,6,7,8-HpCDD	< 0.0085	0.0085	0.017	0.01	0.000085			
OCDD	< 0.011	0.011	0.022	0.001	0.000011			
2,3,7,8-TCDF	< 0.004	0.004	0.008	0.1	0.0004			
1,2,3,7,8-PeCDF	< 0.0084	0.0084	0.017	0.05	0.00042			
2,3,4,7,8-PeCDF	< 0.0084	0.0084	0.017	0.5	0.0042			
1,2,3,4,7,8-HxCDF	< 0.0064	0.0064	0.013	0.1	0.00064			
1,2,3,6,7,8-HxCDF	< 0.0064	0.0064	0.013	0.1	0.00064			
1,2,3,7,8,9-HxCDF	< 0.0064	0.0064	0.013	0.1	0.00064			
2,3,4,6,7,8-HxCDF	< 0.0064	0.0064	0.013	0.1	0.00064			
1,2,3,4,6,7,8-HpCDF	< 0.0071	0.0071	0.014	0.01	0.000071			
1,2,3,4,7,8,9-HpCDF	< 0.0071	0.0071	0.014	0.01	0.000071			
OCDF	< 0.01	0.01	0.02	0.001	0.00001			
I-TEQ from quantified 2,3,7,8-PCDD/Fs - "Lowerbound"					0			
I-TEQ from 2,3,7,8-PCDD/Fs - "Mediumbound"					0.0097			
Maximum possible I-TEQ - "Upperbound"					0.019			
PCDDs	Result [ng/sample]	PCDFs	Result [ng/sample]					
Tetra-CDDs	< 0.11	Tetra-CDFs	< 0.15					
Penta-CDDs	< 0.11	Penta-CDFs	< 0.23					
Hexa-CDDs	< 0.085	Hexa-CDFs	< 0.1					
Hepta-CDDs	< 0.017	Hepta-CDFs	< 0.028					
OCDD	< 0.011	OCDF	< 0.01					

<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  $S/N \geq 3$ .

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/25/12/23****Attachment no. 1 to the Certificate of Analysis for work order PR23D1882**

Sample:

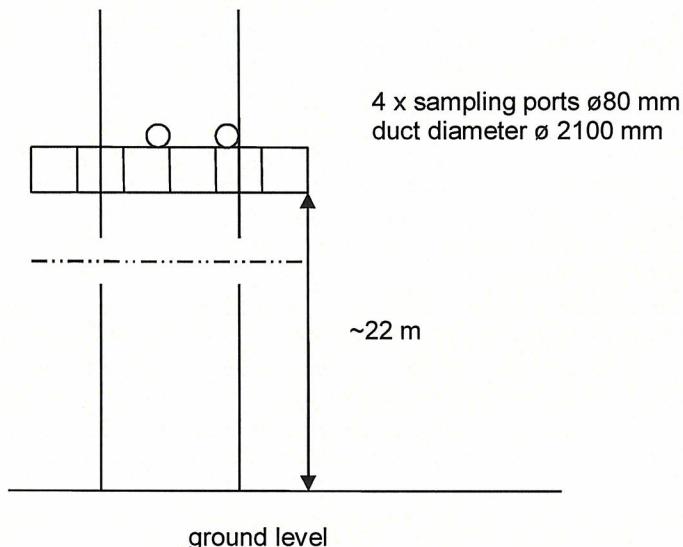
P/83/11/23

**Standards recovery:**

Sample: P/83/11/23					
				Final extract [µl]:	60
				Injection volume [µl]:	4
				Acquisition date [d.m.y h:m]:	1.12.23 18:18
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	84	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,7,8-PeCDD	76	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,7,8-HxCDD	88	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,6,7,8-HxCDD	93	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,6,7,8-HpCDD	92	40 - 130	20 - 150	YES	-
13C12 - OCDD	94	40 - 130	20 - 150	YES	-
<b>PCDFs</b>					
13C12 - 2,3,7,8-TCDF	71	50 - 130	30 - 150	YES	-
13C12 - 2,3,4,7,8-PeCDF	67	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,7,8-HxCDF	91	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,6,7,8-HxCDF	93	50 - 130	30 - 150	YES	-
13C12 - 2,3,4,6,7,8-HxCDF	73	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,6,7,8-HpCDF	96	40 - 130	20 - 150	YES	-
13C12 - OCDF	89	40 - 130	20 - 150	YES	-
Sampling standard	Recovery [%]	Acceptable range [%]		Rec. in range?	
13C12-1,2,3,7,8-PeCDF	90	> 50		YES	
13C12-1,2,3,7,8,9-HxCDF	84	> 50		YES	
13C12-1,2,3,4,7,8,9-HpCDF	62	> 50		YES	

**Test Report No PW/25/12/23**

**10. MEASUREMENT PLANE SCHEME**



Approved by  
  
.....  
Name and Signature

**END OF REPORT**

*The customer has the right to file a complaint on a matter directly related to the test results within 30 days of receiving the report.*

*The results presented apply only to the objects tested.*

*The test report may not be reproduced other than in its entirety without the written consent of the laboratory..*