

CONTRATACIÓN POR PROCEDIMIENTO ABIERTO DE LAS OBRAS DEL PROYECTO DE AMPLIACIÓN DE LA FASE IV, SELLADO Y DESGASIFICACIÓN DE LA FASE III Y AMPLIACIÓN DE LA CAPACIDAD DE TRATAMIENTO DE LIXIVIADOS, ASÍ COMO LA Balsa de Lixiviados Asociada, en el depósito controlado de la Mancomunidad del Sur en los términos municipales de Pinto, Getafe y San Martín de la Vega.

Expediente: 12/2020

ANEXO 1: CARACTERIZACIÓN DEL BIOGÁS

Pliego de Prescripciones Técnicas

LOTE 2

2019	MEDICIÓN LÍNEAS GAS VERTEDERO 2019				MEDICIÓN LÍNEAS GAS DIGESTIÓN 2019			
	O2 %	CO2 %	CH4 %	SH2 ppm	O2 %	CO2 %	CH4 %	SH2 ppm
ENERO	3,6	30,4	42,5	220,0	0,3	33,3	67,5	1.128,0
FEBRERO	2,8	31,5	45,4	93,0	0,2	32,6	66,9	2.123,0
MARZO	2,9	30,5	44,3	95,0	0,2	33,1	67,8	2.086,0
ABRIL	2,7	30,8	42,2	98,0	0,3	32,5	67,6	2.126,0
MAYO	2,8	31,0	42,4	110,0	0,1	32,9	67,2	2.115,0
JUNIO	3,2	31,6	41,3	108,0	0,1	33,2	68,1	2.098,0
JULIO	3,1	31,2	42,2	109,0	0,1	32,8	68,6	1.930,0
AGOSTO	3,0	31,3	42,4	112,0	0,2	33,1	67,8	1.980,0
SEPTIEMBRE	3,1	32,6	47,3	154,0	0,1	35,7	64,2	1.950,0
OCTUBRE	3,1	31,4	45,3	114,0	0,1	34,5	65,2	1.290,0
NOVIEMBRE	2,8	32,7	46,2	130,0	0,2		65,9	1.690,0
DICIEMBRE	2,6	33,3	48,4	110,0	0,1		66,2	1.790,0
<b>Total /media</b>	<b>3,0</b>	<b>31,5</b>	<b>44,2</b>	<b>121,1</b>	<b>0,2</b>		<b>66,9</b>	<b>1.858,8</b>



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Longuich, 25.02.2019

## Report no. B190133218 / 25.02.2019

sample description	PINTO landfill gas
further information	-
gas type	landfill gas
sample receipt	19.02.2019
sampling date / sampled by	14.02.2019 / customer
order no. / order date	031/2019/P000138 / 19.02.2019
sample ID / SAP-order-no.	190133218 / 4867877
gas bag / filling level	10 L Tedlar / 75 %
analyses period	19.02.2019 - 25.02.2019
executing laboratory	SGS INSTITUT FRESENIUS GmbH Laboratory Longuich

### Remarks

No remarks.

**i. V. Dr. Thomas Häusler**

(Laboratory Director)

**i. A. Natalie Kasperowski**

(Environment, Health and Safety)

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Geschäftsführer: Stefan Steinhardt, Aufsichtsratsvorsitzender: Dirk Hellemans, Sitz der Gesellschaft: Taunusstein, HRB 21543 Amtsgericht Wiesbaden



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Parameter	unit	result	100 % CH4
<b>Main components</b>			
Methane	vol.- %	41,0	-
Carbon dioxide	vol.- %	30,3	-
Oxygen	vol.- %	3,9	-
Nitrogen	vol.- %	24,4	-
<b>Inorganic trace gases</b>			
Ammonia	mg/m <sup>3</sup> <sub>N</sub>	1,8	4,4
Hydrogen sulphide	mg/m <sup>3</sup> <sub>N</sub>	124	302
<b>Halogenated Hydrocarbons</b>			
Dichlorodifluoromethane (F12)	mg/m <sup>3</sup> <sub>N</sub>	0,5	1,2
Vinylchlorid	mg/m <sup>3</sup> <sub>N</sub>	0,4	1,0
Trichlorofluoromethane (F11)	mg/m <sup>3</sup> <sub>N</sub>	0,5	1,2
1,1-Dichloroethene	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
Dichloromethane	mg/m <sup>3</sup> <sub>N</sub>	1,1	2,7
1,1,2-Trichloro-1,2,2-trifluoroethane (F113)	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
trans-1,2-Dichloroethene	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
1,1-Dichloroethane	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
cis-1,2-Dichloroethene	mg/m <sup>3</sup> <sub>N</sub>	1,7	4,1
Trichloromethane	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
1,2-Dichloroethane	mg/m <sup>3</sup> <sub>N</sub>	0,3	0,7
1,1,1-Trichloroethane	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
Tetrachloromethane	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
Trichloroethene	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
1,1,2-Trichloroethane	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
Tetrachloroethene	mg/m <sup>3</sup> <sub>N</sub>	0,7	1,7
1,1,1,2-Tetrachloroethane	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
<b>BTEX</b>			
Benzene	mg/m <sup>3</sup> <sub>N</sub>	1,9	4,6
Toluene	mg/m <sup>3</sup> <sub>N</sub>	34,9	85,1
Ethylbenzene	mg/m <sup>3</sup> <sub>N</sub>	29,4	71,7
m-/p-Xylene	mg/m <sup>3</sup> <sub>N</sub>	73,5	179,3
o-Xylene	mg/m <sup>3</sup> <sub>N</sub>	13,3	32,4
<b>Silicon compounds</b>			
Tetramethylsilane	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
Trimethylsilanol	mg/m <sup>3</sup> <sub>N</sub>	8,1	19,8
Hexamethyldisiloxane (L2)	mg/m <sup>3</sup> <sub>N</sub>	2,0	4,9
Hexamethylcyclotrisiloxane (D3)	mg/m <sup>3</sup> <sub>N</sub>	0,7	1,7
Octamethyltrisiloxane (L3)	mg/m <sup>3</sup> <sub>N</sub>	0,4	1,0
Octamethylcyclotetrasiloxane (D4)	mg/m <sup>3</sup> <sub>N</sub>	13,2	32,2
Decamethyltetrasiloxane (L4)	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
Decamethylcyclopentasiloxane (D5)	mg/m <sup>3</sup> <sub>N</sub>	3,5	8,5
Sum silicon compounds (calc.)	mg/m <sup>3</sup> <sub>N</sub>	27,9	68,0
Sum silicon (calc.)	mg/m <sup>3</sup> <sub>N</sub>	9,9	24,1
<b>Hydrocarbons</b>			
> n-Pentane, <= n-Decane	mg/m <sup>3</sup> <sub>N</sub>	394	961
> n-Decane	mg/m <sup>3</sup> <sub>N</sub>	328	800
<b>Total Cl, F, S content (Wickbold)</b>			
Total Fluorine	mg/m <sup>3</sup> <sub>N</sub>	6,0	14,6
Total Chlorine	mg/m <sup>3</sup> <sub>N</sub>	7,7	18,8
Total Sulphur	mg/m <sup>3</sup> <sub>N</sub>	130	317
<b>Gas properties (DIN 51857) [1]</b>			
Molar gross calorific value Hsm	MJ/kmol	366,33	
Molar net calorific value Him	MJ/kmol	330,12	
Molar mass M	kg/kmol	28,1291	
Compressibility factor Z	-	0,99731	
Mass based gross calorific value Hs	MJ/kg	13,023	
Mass based net calorific value Hi	MJ/kg	11,736	
Volume based gross cal. value Hsv	MJ/m <sup>3</sup>	16,388	
Volume based net calorific value Hiv	MJ/m <sup>3</sup>	14,768	
Density	kg/m <sup>3</sup>	1,2584	
Relative density d	-	0,9733	
Upper Wobbe index Wsv	MJ/m <sup>3</sup>	16,611	
Lower Wobbe index Wiv	MJ/m <sup>3</sup>	14,970	
[1] Basis for combustion: T=298,15 K, p=101,325 kPa; gas volume T=273,15 K, p=101,325 kPa			
n. d. = not determined, n. a. = not applicable			

n. d. = not determined, n. a. = not applicable

Methods of analyses

\*) accredited acc. DIN EN ISO/IEC 17025 (D-PL-14115-18)

The values in the column "100% CH<sub>4</sub>" refer to 100 % Methane.

Main components (CH <sub>4</sub> ,CO <sub>2</sub> ,O <sub>2</sub> ,N <sub>2</sub> ), H <sub>2</sub> , CO	in-house-method *) i. A. DIN 51872-04-A:1990-06 (GC-TCD), refer to dry gas
Total Cl, F, S (Wickbold)	in-house-method *) i.A. DIN EN 24260:1994-05, DIN EN 10304-1:2009-07 (IC)
Silicon compounds	in-house-method i. A. VDI 3865-4:2000-12 (GC-MS)
Ammonia	VDI 3496-1:1982-04 ) / colorimetric
Hydrogen sulphide	DIN 51855-4:1995-06 / colorimetric
Hydrocarbons	in-house-method i. A. VDI 3865-4:2000-12 (GC-FID)
BTEX, LCHC, FCHC	in-house-method i. A. VDI 3865-4:2000-12 (GC-MS)

- end of report -



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Longuich, 18.07.2019

**Report no. B190747807 / 18.07.2019**

sample description	PINTO landfill gas
further information	-
gas type	landfill gas
sample receipt	11.07.2019
sampling date / sampled by	09.07.2019 / customer
order no. / order date	031/2019/P000138 / 19.02.2019
sample ID / SAP-order-no.	190747807 / 4867877
gas bag / filling level	10 L Tedlar / 50 %
analyses period	11.07.2019 - 18.07.2019
executing laboratory	SGS INSTITUT FRESENIUS GmbH Laboratory Longuich

**Remarks**

No remarks.

**i. A. Ute Geißler**

(Assistant Laboratory Director)

**i. A. Natalie Kasperowski**

(Environment, Health and Safety)

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parameter	unit	result	100 % CH4
<b>Main components</b>			
Methane	vol.- %	42,4	-
Carbon dioxide	vol.- %	32,0	-
Oxygen	vol.- %	3,7	-
Nitrogen	vol.- %	21,7	-
<b>Inorganic trace gases</b>			
Ammonia	mg/m <sup>3</sup> <sub>N</sub>	11,5	27,1
Hydrogen sulphide	mg/m <sup>3</sup> <sub>N</sub>	143	337
<b>Halogenated Hydrocarbons</b>			
Dichlorodifluoromethane (F12)	mg/m <sup>3</sup> <sub>N</sub>	1,1	2,6
Vinylchlorid	mg/m <sup>3</sup> <sub>N</sub>	0,5	1,2
Trichlorofluoromethane (F11)	mg/m <sup>3</sup> <sub>N</sub>	1,5	3,5
1,1-Dichloroethene	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
Dichloromethane	mg/m <sup>3</sup> <sub>N</sub>	1,0	2,4
1,1,2-Trichloro-1,2,2-trifluoroethane (F113)	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
trans-1,2-Dichloroethene	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
1,1-Dichloroethane	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
cis-1,2-Dichloroethene	mg/m <sup>3</sup> <sub>N</sub>	1,6	3,8
Trichloromethane	mg/m <sup>3</sup> <sub>N</sub>	0,1	0,2
1,2-Dichloroethane	mg/m <sup>3</sup> <sub>N</sub>	0,4	0,9
1,1,1-Trichloroethane	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
Tetrachloromethane	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
Trichloroethene	mg/m <sup>3</sup> <sub>N</sub>	0,4	0,9
1,1,2-Trichloroethane	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
Tetrachloroethene	mg/m <sup>3</sup> <sub>N</sub>	0,7	1,7
1,1,1,2-Tetrachloroethane	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
<b>BTEX</b>			
Benzene	mg/m <sup>3</sup> <sub>N</sub>	1,9	4,5
Toluene	mg/m <sup>3</sup> <sub>N</sub>	37,0	87,3
Ethylbenzene	mg/m <sup>3</sup> <sub>N</sub>	25,6	60,4
m-/p-Xylene	mg/m <sup>3</sup> <sub>N</sub>	63,4	149,5
o-Xylene	mg/m <sup>3</sup> <sub>N</sub>	11,4	26,9
<b>Silicon compounds</b>			
Tetramethylsilane	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
Trimethylsilanol	mg/m <sup>3</sup> <sub>N</sub>	9,4	22,2
Hexamethyldisiloxane (L2)	mg/m <sup>3</sup> <sub>N</sub>	2,4	5,7
Hexamethylcyclotrisiloxane (D3)	mg/m <sup>3</sup> <sub>N</sub>	0,7	1,7
Octamethyltrisiloxane (L3)	mg/m <sup>3</sup> <sub>N</sub>	0,4	0,9
Octamethylcyclotetrasiloxane (D4)	mg/m <sup>3</sup> <sub>N</sub>	18,6	43,9
Decamethyltetrasiloxane (L4)	mg/m <sup>3</sup> <sub>N</sub>	< 0,1	< 0,2
Decamethylcyclopentasiloxane (D5)	mg/m <sup>3</sup> <sub>N</sub>	7,0	16,5
Sum silicon compounds (calc.)	mg/m <sup>3</sup> <sub>N</sub>	38,5	90,8
Sum silicon (calc.)	mg/m <sup>3</sup> <sub>N</sub>	13,9	32,8
<b>Hydrocarbons</b>			
> n-Pentane, <= n-Decane	mg/m <sup>3</sup> <sub>N</sub>	458	1080
> n-Decane	mg/m <sup>3</sup> <sub>N</sub>	315	743
<b>Total Cl, F, S content (Wickbold)</b>			
Total Fluorine	mg/m <sup>3</sup> <sub>N</sub>	7,4	17,5
Total Chlorine	mg/m <sup>3</sup> <sub>N</sub>	9,5	22,4
Total Sulphur	mg/m <sup>3</sup> <sub>N</sub>	141	333
<b>Gas properties (DIN 51857) [1]</b>			
Molar gross caloric value Hsm	MJ/kmol	378,29	
Molar net caloric value Him	MJ/kmol	340,91	
Molar mass M	kg/kmol	28,2345	
Compressibility factor Z	-	0,99717	
Mass based gross caloric value Hs	MJ/kg	13,398	
Mass based net caloric value Hi	MJ/kg	12,074	
Volume based gross cal. value Hsv	MJ/m <sup>3</sup>	16,925	
Volume based net caloric value Hiv	MJ/m <sup>3</sup>	15,253	
Density	kg/m <sup>3</sup>	1,2633	
Relative density d	-	0,9771	
Upper Wobbe index Wsv	MJ/m <sup>3</sup>	17,123	
Lower Wobbe index Wiv	MJ/m <sup>3</sup>	15,431	

[1] Basis for combustion: T=298,15 K, p=101,325 kPa;  
gas volume T=273,15 K, p=101,325 kPa

n. d. = not determined, n. a. = not applicable

**Methods of analyses**

\*) accredited acc. DIN EN ISO/IEC 17025 (D-PL-14115-18)

The values in the column "100% CH<sub>4</sub>" refer to 100 % Methane.

Main components (CH <sub>4</sub> ,CO <sub>2</sub> ,O <sub>2</sub> ,N <sub>2</sub> ), H <sub>2</sub> , CO	in-house-method *) i. A. DIN 51872-04-A:1990-06 (GC-TCD), refer to dry gas
Total Cl, F, S (Wickbold)	in-house-method *) i.A. DIN EN 24260:1994-05, DIN EN 10304-1:2009-07 (IC)
Silicon compounds	in-house-method i. A. VDI 3865-4:2000-12 (GC-MS)
Ammonia	VDI 3496-1:1982-04 ) / colorimetric
Hydrogen sulphide	DIN 51855-4:1995-06 / colorimetric
Hydrocarbons	in-house-method i. A. VDI 3865-4:2000-12 (GC-FID)
BTEX, LCHC, FCHC	in-house-method i. A. VDI 3865-4:2000-12 (GC-MS)

- end of report -

