Annual Report 2021: Environmental Performance

Western Bio-Energy Ltd
Longlands Lane,
Margam
Neath Port Talbot
SA13 2NR

Permit Reference: EPR/ZP393GL

Contents

1 Introduction

This report has been compiled by Western Bio-Energy Ltd (WBE) for the Biomass Plant located at Margam, Port Talbot. This report incorporates the annual reporting requirements detailed EPR permit ZP3939GL

- Table S5.1 Reporting of monitoring data
- Table S5.2: Annual production/treatment
- Table S5.3 Performance parameters

The site generates electricity from biomass, accepting and chipping predominantly round wood logs, but the fuel is augmented with virgin wood chips, baled brash bundles, bark peelings, wood shavings and sawdust. These virgin products are also supplemented with the addition of clean recycled wood biofuels.

The site is exempt from the requirements of Industrial Emissions Directive Chapter IV as listed in point (b) of point 31 of Article 3;
The electrical power generated is approximately 14MWe which is exported to the National Grid.

2 Summary

This report summarises the emissions data from the WBL plant for the whole of 2021.
A continuous monitoring system is in operation which monitors particulate matter, nitrogen dioxide, carbon monoxide,
ELV limits are set within the Permit as follows:-

- Particulates 10 mg/m^3
- Carbon Monoxide (CO) 250 mg/m^3
- Oxides of Nitrogen 250 mg/m^3

Flue gases are independently monitored 6 monthly by ECL and these reports are submitted to NRW biannually in the Q2 and Q4 submissions.

3 Emissions To Atmosphere

The main emissions to air are combustion gases as a result of the biomass combustion process, which comprises predominantly of nitrogen oxides, carbon monoxide and particulate matter. These emissions are constantly monitored within the CEMS system, as per the Environmental Permit requirements. Graphs relating to each of the emissions can be found in the following pages.

NOx mg/m³												
Criteria	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Nox Daily mean of hourly ave (max result)	0	247.67	249.38	248.23	268.72	249.34	248.92	250.01	248.62	248.89	249.89	248.16
Nox Daily mean of hourly ave (ave result)	0	238.39	232.28	245.09	245.7	237.52	246.22	246.32	244.73	245.73	246.77	245.26
Nox ELV	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**
Nox 200% ELV	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**

CO mg/m³												
Criteria	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
CO Daily mean of hourly ave (max result)	0	187.43	179.09	144.85	150.16	143.75	157.68	132.45	149.51	194.1	136.82	139.96
CO Daily mean of hourly ave (ave result)	0	131.57	77.92	93.28	109.15	72.64	102.28	87.41	107.23	134.75	103.96	98.19
CO ELV	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**
CO 200% ELV	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**

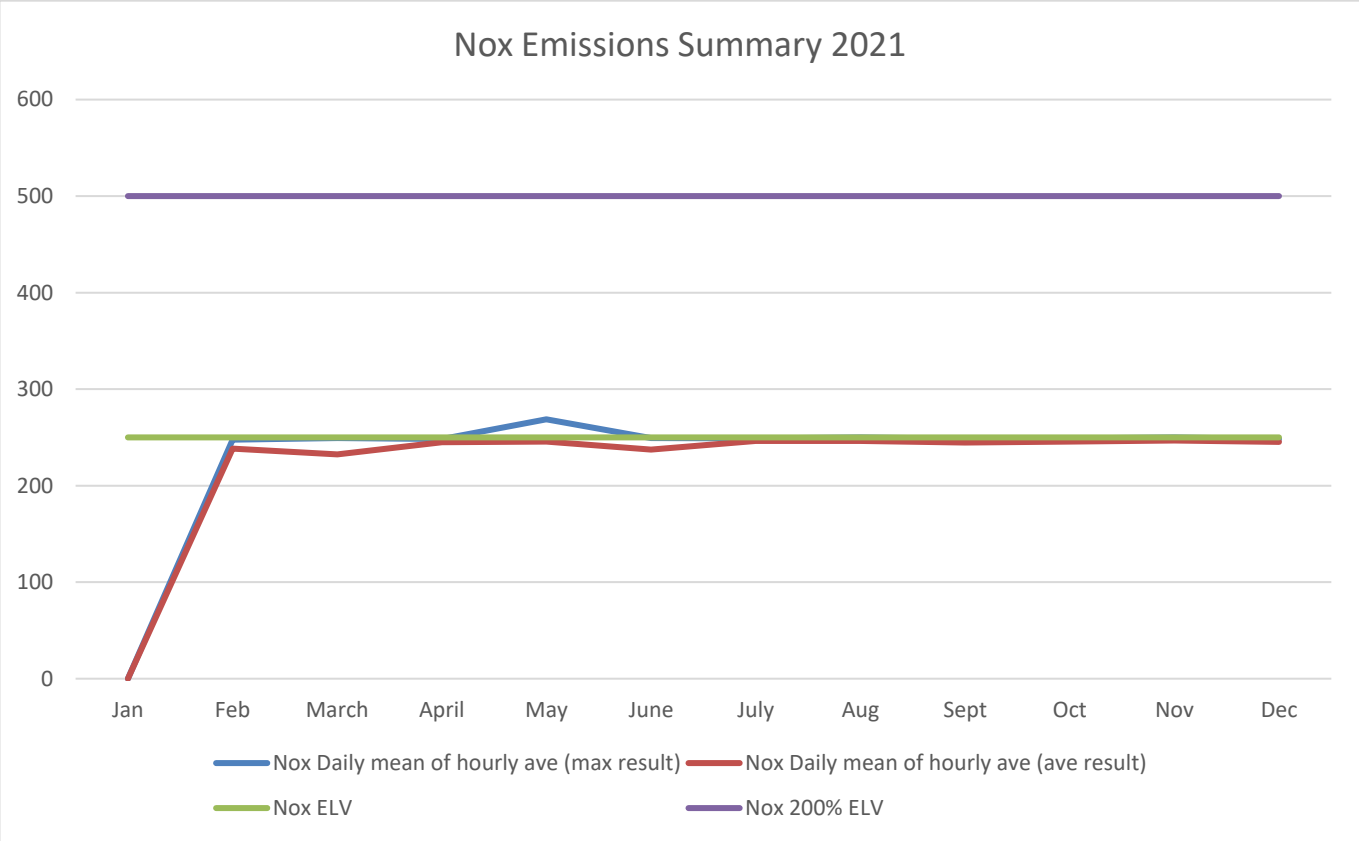
Particulates mg/m³												
Criteria	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Particulate Daily mean of hourly ave (max result)	0	1.94	4.22	7.14	3.68	2.8	2.79	6.98	2.77	5.64	3.84	4.19
Particulate Daily mean of hourly ave (ave result)	0	1.32	3.23	2.47	2.75	1.98	1.86	2.05	1.88	2.05	2.5	1.95
Particulate ELV	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Particulate 200% ELV	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**

Note: Whilst there were some instances of hourly peaks above the ELV, the daily and monthly averages fell within limits for the daily averages as required in the permit.

3.1 Oxides of Nitrogen

Please refer to the graph showing the hourly readings on the following page which shows that the hourly average range of emissions for NOx for the year.
The continuous Emission Limit Values does exceed (ELV) of 250mg/Nm^3 on hourly averages, however 95% of validated hourly averages within a calendar year do not exceed 200% of ELV. The daily average has remained within the ELV 250mg/Nm3 set within the permit and appear stable during the year

3.1.1 Graph profile depicting hourly averages of NOx measured at Stack

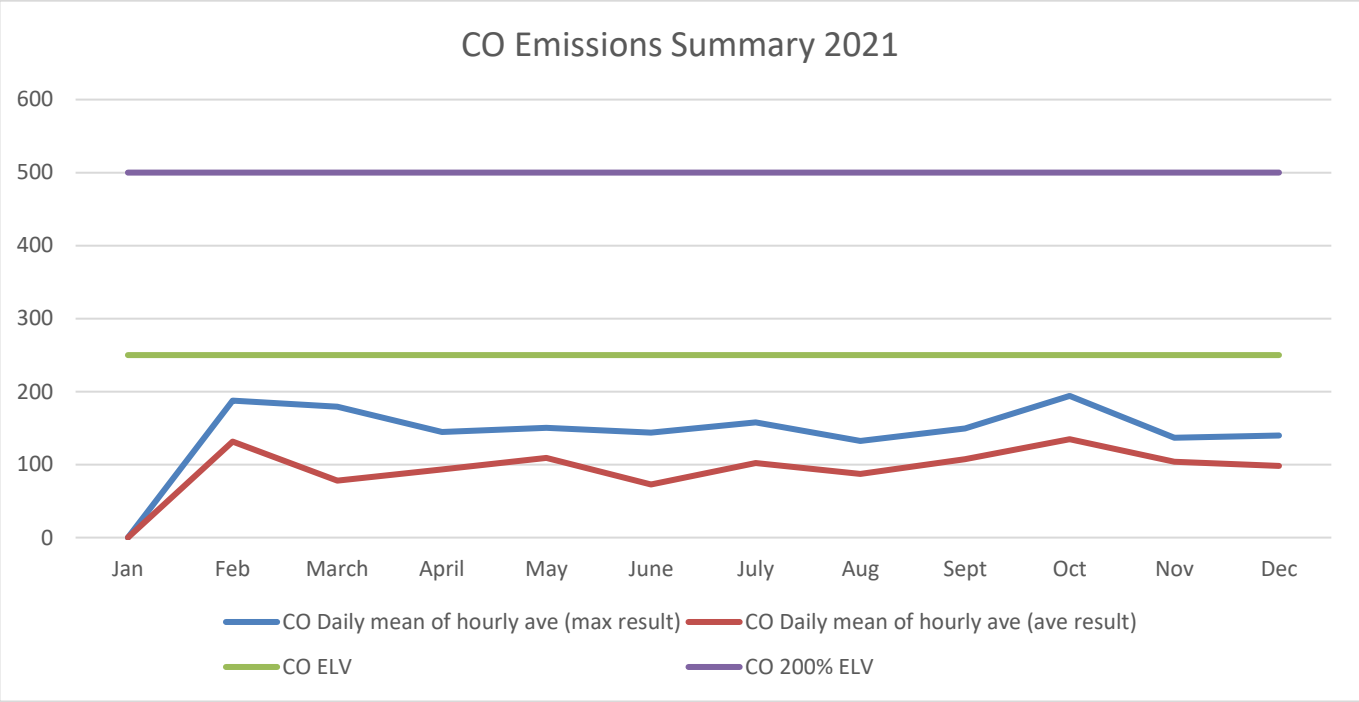


As can be seen from the above results, there was a Nox breach in May due to a training issue with the new Nox abatement system resulting in late activation and subsequent breach. This breach was notified to NRW as required and the root cause been suitabley addressed.

3.2 Carbon Monoxide

Please refer to the graph showing the hourly readings on the following page which shows that the hourly average range of emissions for carbon Monoxide (CO) for the year.
The continuous Emission Limit Values does exceed (ELV) of 250mg/Nm^3 on hourly averages, however 95% of validated hourly averages within a calendar year do not exceed 200% of ELV. The daily average has remained within the ELV 250mg/Nm3 set within the permit and appear stable during the year

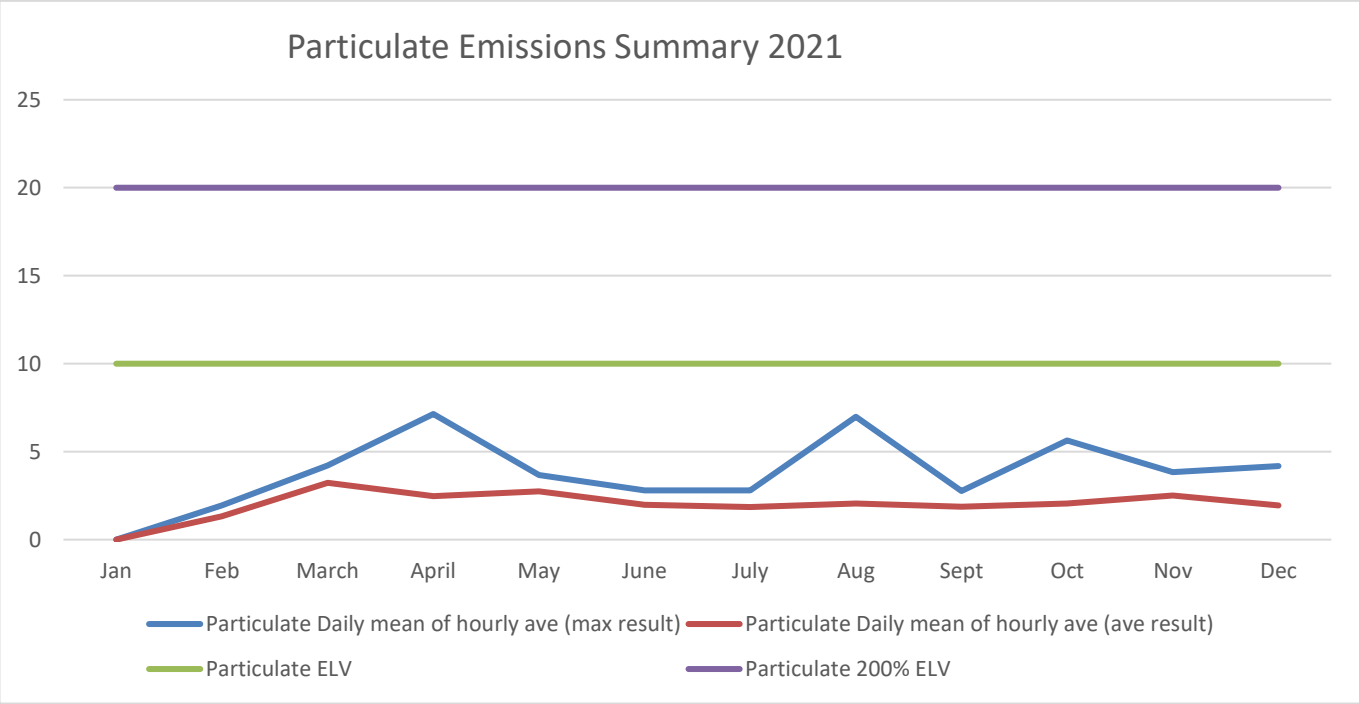
3.2.1 Graph profile depicting hourly averages of CO measured at Stack



3.3 Particulates

A mostly very consistent result indicates a good performance of the facilities bag filter house.
The continuous Emission Limit Values does exceed (ELV) of 10mg/Nm3 on hourly averages, however 95% of validated hourly averages within a calendar year do not exceed 200% of ELV. The daily average has remained within the ELV 10mg/Nm3 set within the permit and appear stable during the year

3.3.1 Graph profile depicting hourly averages of Particulate matter measured at Stack



4 Ash Residues

Both bottom and fly ashes were monitored monthly during 2021 with the analysis being performed by Socotec for the normal suite of parameters. The Dioxins and Furans for both the bottom and fly ashes were sampled and analysed quarterly by Marchwood Scientific with the combined results shown below:

All the analyses are on an 'as received' basis. The heavy metal contents are analysed on a 'dry' basis, reported in mg/kg. Dioxins, Furans & PCB's are reported in ng/kg.

Note (*) For both the Bottom and Fly ash analysis in Q1 (March 2021), the PCB's analysis was not requested due to the relevant site personnel's' absence due to Covid. This was subsequently raised and requested in the following Quarterly analysis for the remainder of 2021

4.1 Table of Bottom Ash Residues

Bottom Ash	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Antimony	8.6	7.9	11.9	10.7	2.1	32.0	8.7	8.8	9.4	4.4	10.7	5.4
Arsenic	49.7	42.8	79.8	56.5	29.3	335.7	81.9	42.8	88.6	54.5	68.8	59.3
Cadmium	15.4	13.2	36.8	0.5	0.5	9.8	1.3	1.6	2.1	0.6	1.7	8.0
Chromium	81.3	76.5	128.5	66.6	50.6	67.7	71.2	46.9	82.6	69.8	75.0	91.4
Cobalt	9.1	8.3	14.0	4.0	4.0	3.0	4.3	4.8	6.2	6.2	5.8	5.4
Copper	1,815.4	340.7	474.7	301.7	639.8	248.1	830.2	243.0	506.9	344.3	323.2	777.1
Lead	1,365.5	614.7	1,807.1	241.4	60.2	506.7	86.9	137.8	198.8	74.2	168.8	158.9
Manganese	8,208.9	7,949.1	5,429.3	700.6	481.3	540.7	550.9	573.7	725.5	558.3	508.8	551.5
Mercury	<0.1	<0.1	<0.1	<0.1	<0.1	1.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	47.6	36.5	69.1	12.5	43.7	9.5	14.3	15.2	16.7	16.9	15.9	23.6
Thallium	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	19.6	18.2	22.7	14.2	14.3	11.1	11.3	20.5	23.0	12.3	18.3	20.6
Zinc	1,010.3	6,843.8	1,285.0	453.4	209.5	949.0	405.8	585.3	572.3	309.8	421.5	3,893.6
TOC's	0.9	1.3	0.9	0.9	0.5	8.2	1.3	0.9	1.3	1.4	1.2	0.9
Dioxins			38.2			296			732			337
Furans			7.96			76.7			172			93.3
PCB's			N/A *			29.6			51.5			37

4.2 Table of Fly Ash Residues

Fly Ash	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Antimony	41.5	35.3	12.3	165.5	71.5	7.2	121.1	2.6	120.3	56.0	34.1	104.2
Arsenic	165.0	196.4	66.9	969.3	825.3	53.6	1,276.6	13.3	940.1	513.7	189.6	1,134.8
Cadmium	33.2	26.8	24.2	28.6	31.1	1.5	29.9	21.9	25.4	11.9	19.0	20.7
Chromium	60.0	66.0	93.5	248.2	341.0	64.2	247.2	17.9	200.0	129.3	64.4	311.8
Cobalt	6.4	4.8	9.4	6.2	6.1	6.2	5.9	6.0	8.1	3.8	4.2	7.4
Copper	315.9	269.9	363.0	846.2	756.1	340.5	1,241.2	400.4	944.8	566.8	482.5	1,677.5
Lead	850.2	787.6	1,680.0	4,703.6	2618.4	141.3	4,601.7	774.7	3,467.5	2,235.0	1,895.8	4,667.5
Manganese	1,952.0	1,389.9	5,050.0	1,175.9	1493.9	938.1	1,089.9	1,247.6	1,316.6	728.5	1,014.1	1,351.9
Mercury	1.5	1.2	1.2	3.0	1.8	1.2	5.9	1.3	3.4	2.4	1.2	3.6
Nickel	21.1	17.1	39.2	16.2	20.6	15.8	17.3	18.7	24.5	11.2	12.5	18.9
Thallium	0.6	0.8	0.2	0.5	0.4	<0.1	0.6	0.7	0.8	0.6	0.7	1.0
Vanadium	25.6	19.0	19.1	16.9	15.6	24.6	21.5	1.1	30.9	13.5	13.9	22.1
Zinc	4,346.7	3,384.1	768.0	7,055.3	5127.2	422.8	8,345.6	3,370.6	6,462.6	4,451.0	3,901.9	8,723.2
Dioxins			16,900			49,900			64,900			54,200
Furans			11,700			14,700			13,000			16,200
PCB's			N/A *			3,382			5,290			4,830

5 Wastes Trade Effluents

Western Bio-Energy Plant has a Trade Effluent Discharge Consent for process waters and boiler blow and drain downs and wastewater from the demineralisation process.

The pH threshold in the consent is set between 6.0 and 10.0. There have been three non-conformities during the year where the pH has been outside these limits and these have been traced to isolated occurrences.
Welsh water have been contacted and are not concerned about these readings being slightly above the high limit.

Other parameters within the consent include:-

- COD at pH 7 shall not exceed 500 mg/l
- Suspended solids shall not exceed 500 mg/l
- Mineral oil shall not exceed 100 mg/l

The results from the analyses on the table below demonstrate that the above parameters are well within consent in 2021

5.1 Table of results from Trade waste

Parameter	PH HL-10 LL-6	Suspended Solids HL-500mg/1	Oil & Grease HL-100mg/1	COD HL-500MG/!	BOD HL-250mg/1	Toxic Metals HL-2mg/1	Sulphate HL-1000mg/1
Jan							
Feb							
Mar							
Apr	8.3	24	<1	33	11	<1	28.6
May	10.9	20	<1	31	3.9	0.1	221
Jun	9.8	10	<1	6	3.2	0.06	87
Jul	9	14	<1	27	4.7	0.06	211
Aug	11	24	<1	34	3.2	0.24	347
Sep	10.9	20	<1	11	2.7	0.15	446
Oct	8.9	35	<1	28	6.1	0.15	145
Nov	9.5	36	<1	61	13	0.67	194
Dec	9.8	36	<1	38	6.9	1.9	163

The plant entered commissioning during the month of February and this continued until the end of April. Testing of the trade waste discharge commenced in April and was delayed due to staff absence through Covid 19.

6 Fuels

The table below shows the fuel composition for 2021. The total tonnage of biomass combusted through the plant was 126,642te.

During 2021, 49 % of the energy was derived from recycled sources.

Wood Type	Tonnes	GJ's	Weighted Average Moisture Content	Net Calorific Value GJ/te	%age of Energy
OS Arboreal Cuttings	25,171	463,361	43.69%	18.41	19.86%
Log Whole logs	12,343	227,261	41.96%	18.41	9.74%
Log Chip	2,383	43,891	38.92%	18.42	1.88%
RCF Grade A woodchip	36,598	675,098	25.64%	18.45	28.94%
WTC Whole Tree Chip	47,713	878,172	45.23%	18.41	37.65%
Brash	2,011	37,022	43.18%	18.41	1.59%
Peelings	423	7,796	33.17%	18.43	0.33%
TOTAL	**126,642**	**2,332,600**	**38.83%**	**18.42**	**100.00%**

The quantity of Fuel oil used to ignite and maintain residual heat inside the boiler, during the year 2021 totalled 82,090 litres.

Periodic monitoring was performed in undertaken in May 2021 and November 2021 with results submitted in the Q2 and Q4 submissions respectively.

6.1 Additional Information as Required

Annual production / treatment as req. table s5.2		Units
Total virgin biomass	64,873	te
Total waste biomass	61,769	te
Electrical export energy	87,545	MWh
Electrical energy used at site	404.89	MWh
Performance Parameters as req. table performance s5.3		**Units**
Supplementary fuel oil usage	82,090	litres
Water usage	35,568	M^3
Bottom ash generated	4110.62	te
Flue gas residues generated	375.32	te
Average calorific value of biomass (wet)Net CV	9.4	MJ/kg
Number of start ups	22	No.
Bag filter bypass events & time	0 events during operation,	No. & time
Rejected fuel loads i.e. outside agreed spec.	41	No: of loads
Average plant availability *(Feb to Dec)*	91.3	%

7 Conclusions

Whilst 2021 was largely a commissioning year for both the plant, SNCR pollution abatement systems along with being a development year for the processing of new fuels and blends under a revised permit, the plant operated under mainly stable conditions with only one Schedule 6 NOx Daily breach reported for the 12th May 2021.

The Nox breach was caused due to the incorrect operation of the Nox abatement system after restarting on the plant resulting in a breach of the limit, this was subsequently addressed by retraining and verification post breach.