Widnes Biomass Facility

MERSEY BIOENERGY LTD

Annual Performance Report 2022

Annual Performance Report for Widnes Biomass Facility

Permit number: EPR/JP3132RV

Year: 2022

MERSEY BIOENERGY

WIDNES BIOMASS
CHP PLANT

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Issue	Date Issued	Issued by
Issued to EA	31 January 2023	Anna Whitelegg

Note

This report is required under the Industrial Emissions Directive's Article 55(2) requirements on reporting and public information on waste incineration plants and co-incineration plants, which require the operator to produce an annual report on the functioning and monitoring of the plant and make it available to the public.

1 Introduction

Name and Address of the Plant:	Widnes Biomass Facility Mathieson Road, Widnes Cheshire WA8 0PX
Description of Waste Input:	Grade C waste wood
Operator contact details if members of the public have any questions:	Mersey Bioenergy Ltd C/O Bioenergy Infrastructure Limited Davidson House, Forbury Square, Reading, England, RG1 3EU

2 Plant Description

The installation is a single incinerator with an inclined grate for the combustion of waste wood chips, a conventional steam-raising boiler, a steam turbine generator for the production of electricity and a flue gas cleaning system to ensure compliance with the Industrial Emissions Directive ("IED").

Grade C Waste Wood ("the fuel") is brought to the site by road transport (mainly from a wood processing facility less than a mile away, but also vehicles from other supply warehouses in the UK), which enters the site via a weighbridge.

Fuel is delivered in walking floor trailers, and weighed at the weighbridge at the entrance to the site, before being delivered to one of two fuel reception pits. Drag chain conveyors in the floor of the reception pits automatically discharge fuel through a magnetic metals separator, an oversize separator, and a non-magnetic metals separator, before being elevated by conveyors to the waste wood storage feed-in system.

Inspection of the fuel takes place in the unloading station area. Visible inspection of the load can only occur after the lorry has discharged its load; therefore, if a load requires rejection, it is transported through the conveyor system to the rejection pit. Should a load appear to not meet the specification or appear to be likely to cause difficulties to the fuel handling system or boiler grate, it can be diverted to a reject area by the fuel reception conveying system.

The fuel storage facility consists of three individual storage cells, each equipped with a loading and unloading conveyor. The three cells can operate independently of each other so provide effective equipment redundancy. A covered inclined drag-link conveyor system on the outside wall of the storage facility transports the fuel from the storage area to the boiler house.

The grate is an inclined reciprocating grate cooled by air. Fuel is fed onto the grate where it is dried by the heat of the furnace and heats up then combusts. The reciprocating action of the grate ensures fuel is steadily transferred along the length of the grate.

Primary heated air is fed from beneath the grate to allow controlled combustion to occur. Each grate line is divided into zones, allowing for fine control of primary combustion air flow and thereby providing control of emissions of carbon monoxide (CO) and nitrogen oxides (NOx). An external hydraulic system provides motive power to the grate.

Two parallel wet ash extractors are installed below the grate. The majority of ash on the grate falls off the end of the grate, and a small proportion of ash falls through the grate bars into the air hoppers below the grate. All ash from the grate passes into a single bottom ash conveyor system. The first part of the bottom ash conveyor is kept flooded

with water to provide a boiler seal and to quench the ash from the grate (bottom ash). An ash conveyor system is also provided to handle ash dropped out from the superheaters, economiser and air preheater sections (boiler ash); the boiler ash streams are returned to the bottom ash system.

The boiler is a water-tube natural circulation boiler designed for generation of steam. The steam drum is installed on top of the boiler drum pressure vessel and is connected with the lower header through the exterior unheated downpipes. The boiler furnace and flue gas path is designed with membrane walls to provide a gas-tight pressure vessel and enable good heat transfer. Flue gases flow vertically through the combustion chamber and the heating surfaces. After exiting the vertical furnace, flue gases flow vertically downward through an empty second pass, allowing additional heat transfer to steam generation tubes and allows the flue gases sufficient residence time above 850°C to meet the minimum requirements of the IED. For cleaning purposes, the boiler is equipped with steam operated soot blowers.

The flue gas treatment (FGT) system includes dry lime injection and powdered activated carbon (PAC) injected upstream of a bag filter system. The boiler also has a complete SNCR system to remove nitrous oxides from the flue gases.

The economiser and air preheaters are installed after the boiler and designed to optimise the boiler efficiency. The economiser is a plain tube bundle located downstream of the superheaters and is designed to exchange heat between flue gas and boiler feed water.

Supplementary oil fired burners are used to ensure that the combustion temperature of the waste combustion gases are raised to a minimum of 850°C at all times when waste is being burned on the incinerator grate and particularly during start up and shut down.

Heat from the burning of the waste is used in the heat recovery boiler to raise steam which is then used to drive a steam turbine which is coupled to a generator via a gearbox. The generated electricity is used for powering plant auxiliaries, using 11kV to 440v step down transformers. The surplus generated electricity is exported to the national grid via 11kV to 33kV transformers

In the event that the turbine/generator set is off-line, the site imports electricity via the same transformers but in the reverse direction i.e. 33kV to 11kV.

The site has an emergency diesel generator sufficient capacity to allow the plant to be safely shut down in the event of a failure of the 33kV connection.

3 Summary of Plant Operation

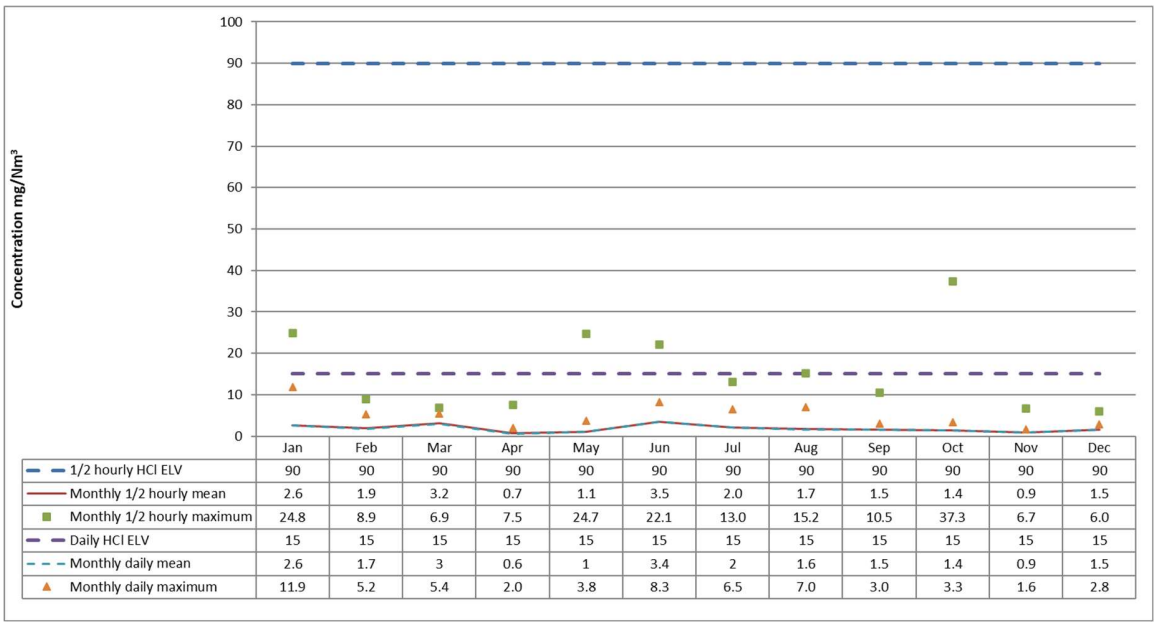
Waste wood (biomass) received	132,199.45 tonnes
Total waste received	132,199.45 tonnes
Total plant operational hours	7,270 hours
Total hours of "abnormal operation" (see permit for definition)	0 hours
Total quantity of incinerator bottom ash (IBA) produced	7,637.31 tonnes
Disposal or recovery route for IBA	Hazardous Landfill
Did any batches of IBA test as hazardous? If yes, state quantity	Yes – a composite sample from several quarters across 2022 tested as Hazardous
Total quantity of air pollution control (APC) residues produced	2,978.00 tonnes
Disposal or recovery route for APC residues	Hazardous Landfill
Total electricity generated for export to the National Grid	134,976.08 MWh
Total heat produced for export (e.g. to hospital or district heating scheme)	54,054.17 MWth

4 Summary of Plant Emissions

4.1 Summary of continuous emissions monitoring results for emissions to air

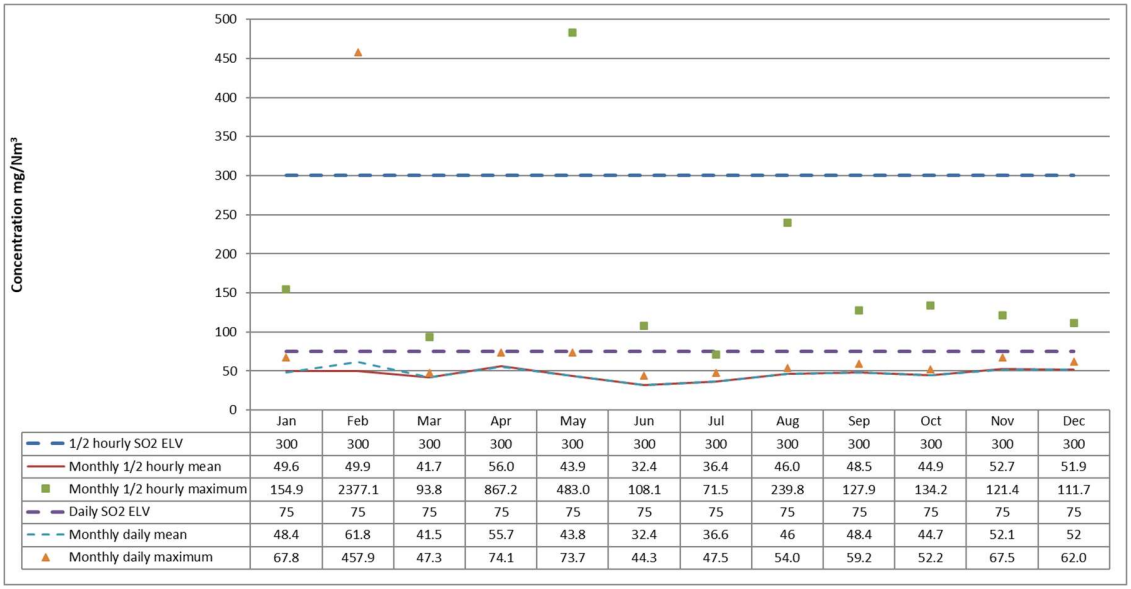
The following charts show the performance of the plant against its emission limit values (ELVs) for substances that are continuously monitored.

Line 1 - Hydrogen chloride



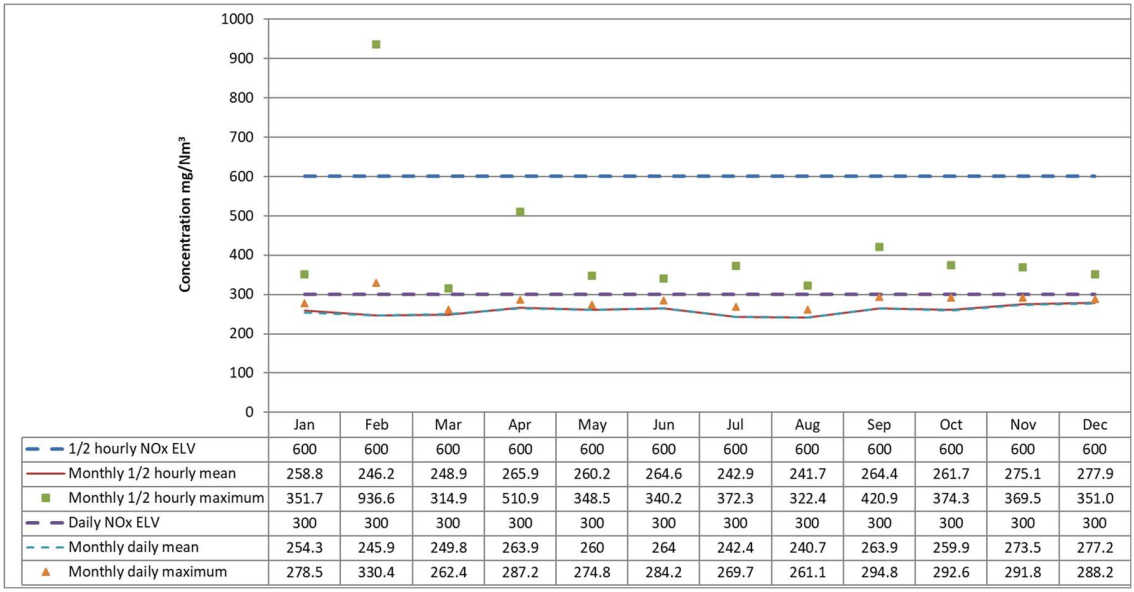
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/2 hourly HCl ELV	90	90	90	90	90	90	90	90	90	90	90	90
Monthly 1/2 hourly mean	2.6	1.9	3.2	0.7	1.1	3.5	2.0	1.7	1.5	1.4	0.9	1.5
Monthly 1/2 hourly maximum	24.8	8.9	6.9	7.5	24.7	22.1	13.0	15.2	10.5	37.3	6.7	6.0
Daily HCl ELV	15	15	15	15	15	15	15	15	15	15	15	15
Monthly daily mean	2.6	1.7	3	0.6	1	3.4	2	1.6	1.5	1.4	0.9	1.5
Monthly daily maximum	11.9	5.2	5.4	2.0	3.8	8.3	6.5	7.0	3.0	3.3	1.6	2.8

Line 1 – Sulphur dioxide



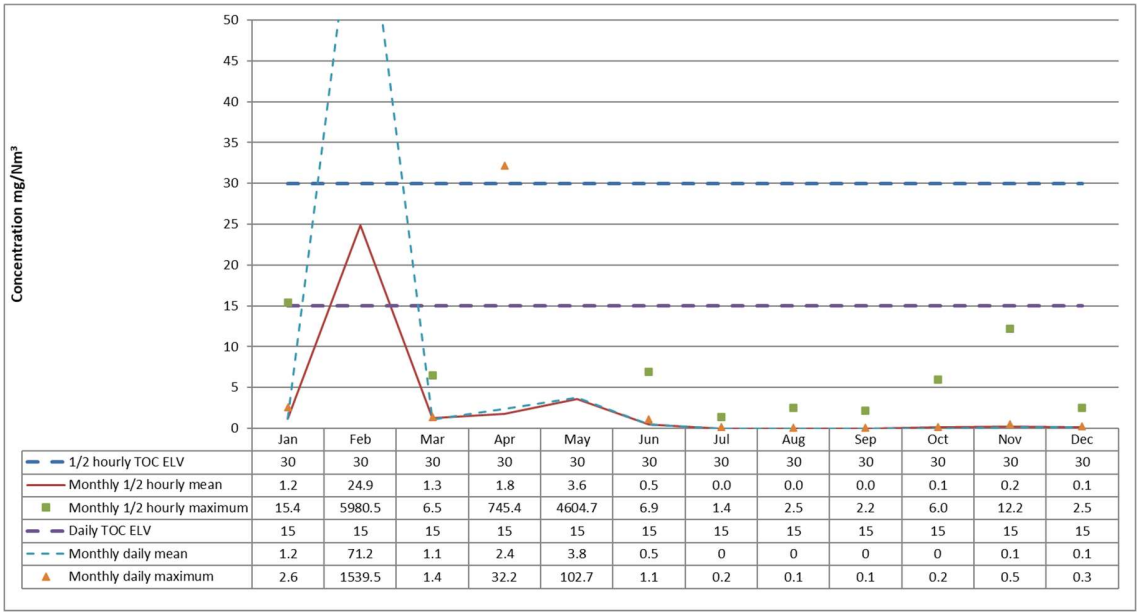
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/2 hourly SO2 ELV	300	300	300	300	300	300	300	300	300	300	300	300
Monthly 1/2 hourly mean	49.6	49.9	41.7	56.0	43.9	32.4	36.4	46.0	48.5	44.9	52.7	51.9
Monthly 1/2 hourly maximum	154.9	2377.1	93.8	867.2	483.0	108.1	71.5	239.8	127.9	134.2	121.4	111.7
Daily SO2 ELV	75	75	75	75	75	75	75	75	75	75	75	75
Monthly daily mean	48.4	61.8	41.5	55.7	43.8	32.4	36.6	46	48.4	44.7	52.1	52
Monthly daily maximum	67.8	457.9	47.3	74.1	73.7	44.3	47.5	54.0	59.2	52.2	67.5	62.0

Line 1 – Oxides of nitrogen



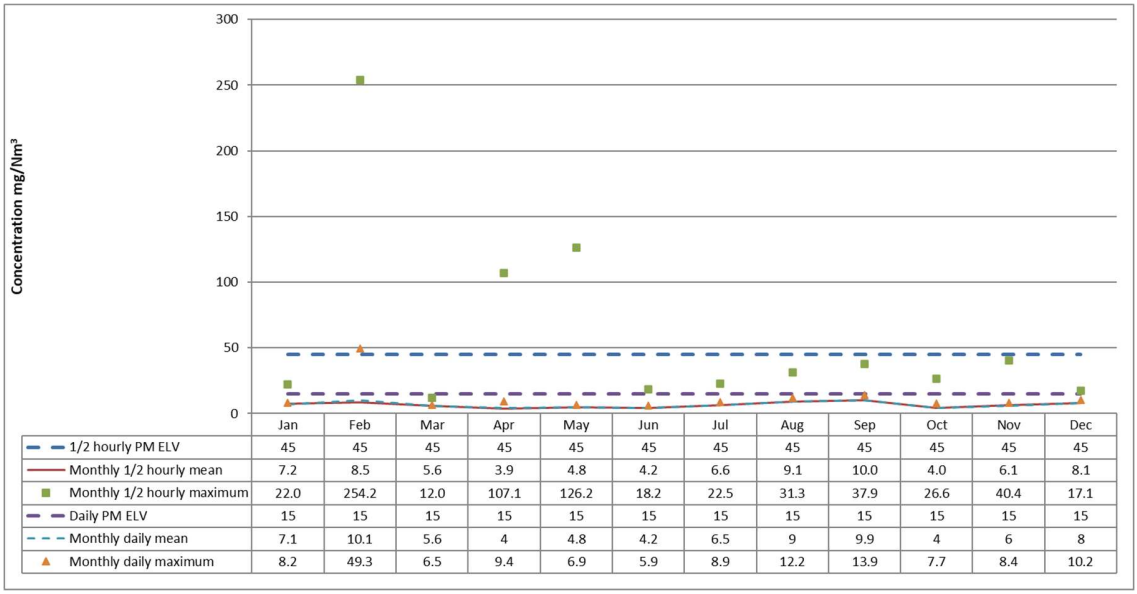
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/2 hourly NOx ELV	600	600	600	600	600	600	600	600	600	600	600	600
Monthly 1/2 hourly mean	258.8	246.2	248.9	265.9	260.2	264.6	242.9	241.7	264.4	261.7	275.1	277.9
Monthly 1/2 hourly maximum	351.7	936.6	314.9	510.9	348.5	340.2	372.3	322.4	420.9	374.3	369.5	351.0
Daily NOx ELV	300	300	300	300	300	300	300	300	300	300	300	300
Monthly daily mean	254.3	245.9	249.8	263.9	260	264	242.4	240.7	263.9	259.9	273.5	277.2
Monthly daily maximum	278.5	330.4	262.4	287.2	274.8	284.2	269.7	261.1	294.8	292.6	291.8	288.2

Line 1 – Total organic carbon



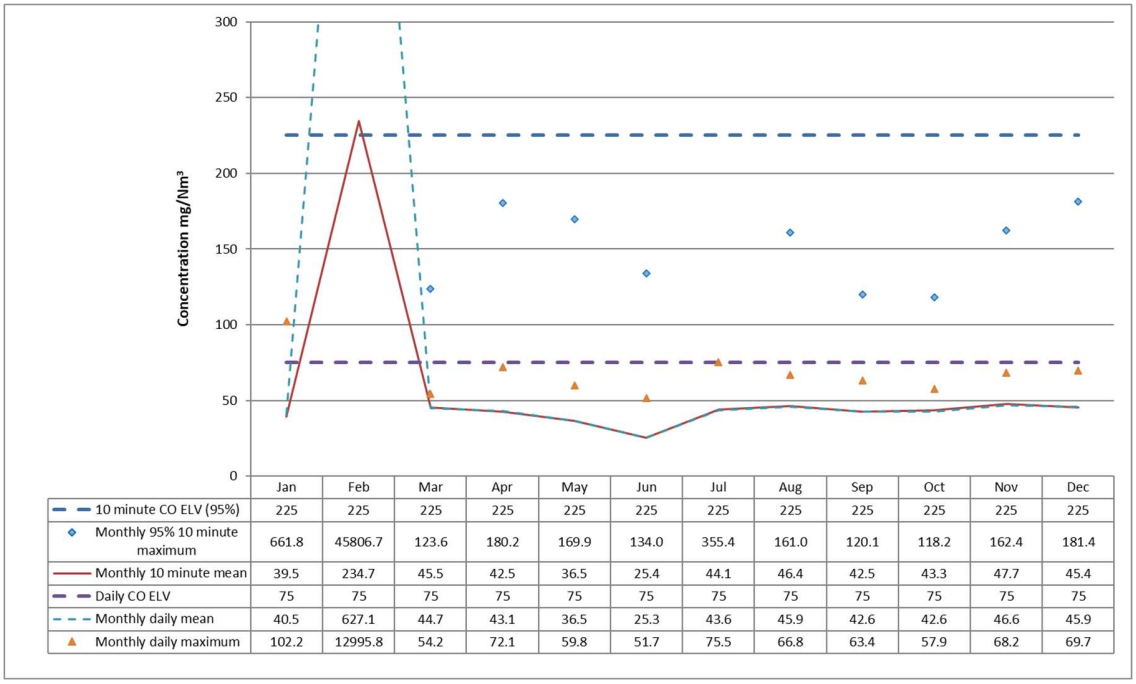
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/2 hourly TOC ELV	30	30	30	30	30	30	30	30	30	30	30	30
Monthly 1/2 hourly mean	1.2	24.9	1.3	1.8	3.6	0.5	0.0	0.0	0.0	0.1	0.2	0.1
Monthly 1/2 hourly maximum	15.4	5980.5	6.5	745.4	4604.7	6.9	1.4	2.5	2.2	6.0	12.2	2.5
Daily TOC ELV	15	15	15	15	15	15	15	15	15	15	15	15
Monthly daily mean	1.2	71.2	1.1	2.4	3.8	0.5	0	0	0	0	0.1	0.1
Monthly daily maximum	2.6	1539.5	1.4	32.2	102.7	1.1	0.2	0.1	0.1	0.2	0.5	0.3

Line 1 – Particulates



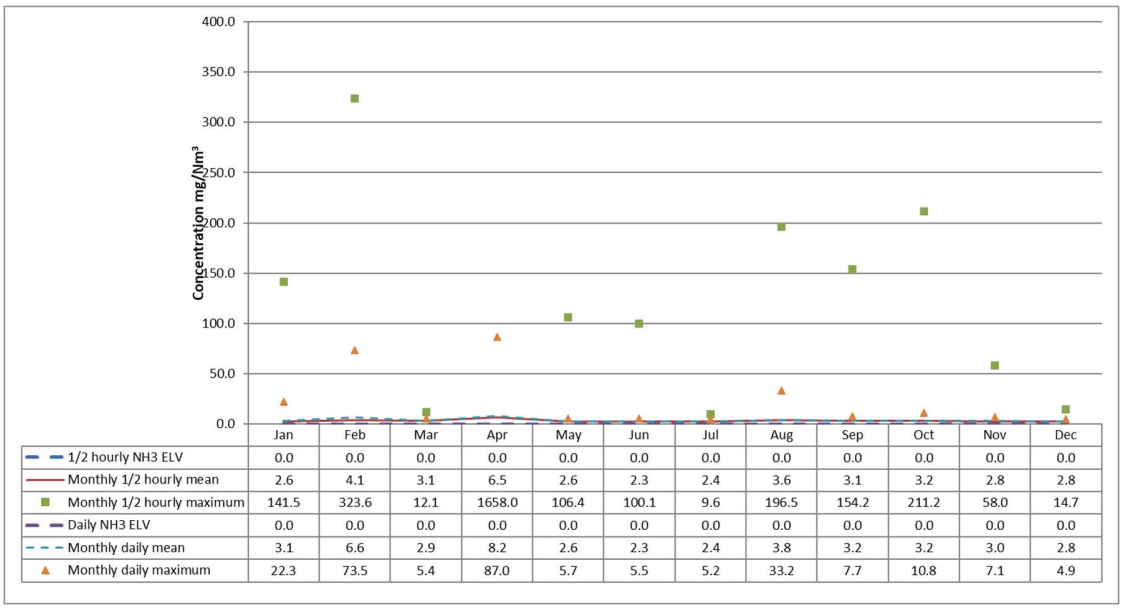
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/2 hourly PM ELV	45	45	45	45	45	45	45	45	45	45	45	45
Monthly 1/2 hourly mean	7.2	8.5	5.6	3.9	4.8	4.2	6.6	9.1	10.0	4.0	6.1	8.1
Monthly 1/2 hourly maximum	22.0	254.2	12.0	107.1	126.2	18.2	22.5	31.3	37.9	26.6	40.4	17.1
Daily PM ELV	15	15	15	15	15	15	15	15	15	15	15	15
Monthly daily mean	7.1	10.1	5.6	4	4.8	4.2	6.5	9	9.9	4	6	8
Monthly daily maximum	8.2	49.3	6.5	9.4	6.9	5.9	8.9	12.2	13.9	7.7	8.4	10.2

Line 1 – Carbon monoxide



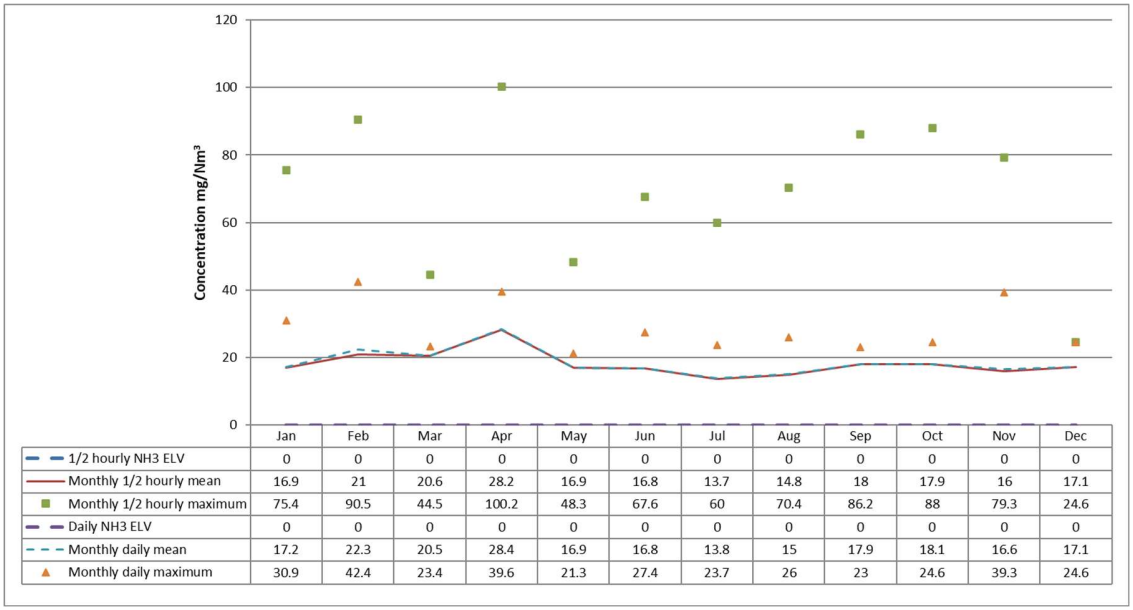
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10 minute CO ELV (95%)	225	225	225	225	225	225	225	225	225	225	225	225
Monthly 95% 10 minute maximum	661.8	45806.7	123.6	180.2	169.9	134.0	355.4	161.0	120.1	118.2	162.4	181.4
Monthly 10 minute mean	39.5	234.7	45.5	42.5	36.5	25.4	44.1	46.4	42.5	43.3	47.7	45.4
Daily CO ELV	75	75	75	75	75	75	75	75	75	75	75	75
Monthly daily mean	40.5	627.1	44.7	43.1	36.5	25.3	43.6	45.9	42.6	42.6	46.6	45.9
Monthly daily maximum	102.2	12995.8	54.2	72.1	59.8	51.7	75.5	66.8	63.4	57.9	68.2	69.7

Line 1 – Ammonia



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/2 hourly NH3 ELV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Monthly 1/2 hourly mean	2.6	4.1	3.1	6.5	2.6	2.3	2.4	3.6	3.1	3.2	2.8	2.8
Monthly 1/2 hourly maximum	141.5	323.6	12.1	1658.0	106.4	100.1	9.6	196.5	154.2	211.2	58.0	14.7
Daily NH3 ELV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Monthly daily mean	3.1	6.6	2.9	8.2	2.6	2.3	2.4	3.8	3.2	3.2	3.0	2.8
Monthly daily maximum	22.3	73.5	5.4	87.0	5.7	5.5	5.2	33.2	7.7	10.8	7.1	4.9

Line 1 – Nitrous oxide



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/2 hourly NH3 ELV	0	0	0	0	0	0	0	0	0	0	0	0
Monthly 1/2 hourly mean	16.9	21	20.6	28.2	16.9	16.8	13.7	14.8	18	17.9	16	17.1
Monthly 1/2 hourly maximum	75.4	90.5	44.5	100.2	48.3	67.6	60	70.4	86.2	88	79.3	24.6
Daily NH3 ELV	0	0	0	0	0	0	0	0	0	0	0	0
Monthly daily mean	17.2	22.3	20.5	28.4	16.9	16.8	13.8	15	17.9	18.1	16.6	17.1
Monthly daily maximum	30.9	42.4	23.4	39.6	21.3	27.4	23.7	26	23	24.6	39.3	24.6

4.2 Summary of periodic monitoring results for emissions to air

The table below shows the results of periodically monitored substances.

Substance	Emission limit value	Results	
		17th-21st Jan 2022	1st-5th Aug 2022
Mercury and its compounds	0.05 mg/m³	0.00077 mg/m³	0.001 mg/m³
Cadmium & thallium and their compounds (total)	0.05 mg/m³	0.023 mg/m³	0.001 mg/m³
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total)	0.5 mg/m³	0.33 mg/m³*	0.25 mg/m³
Dioxins and furans (I-TEQ)	0.1 ng/m³	0.031 ng/m³	0.045 ng/m³
Hydrogen Fluoride	3 mg/m³	0.032 mg/m³	< 0.07 mg/m³

4.3 Summary of periodic monitoring results for emissions to water

There are no emissions to water from the process.

5 Summary of Plant Compliance

5.1 Summary of any notifications or non-compliances under the permit

Date	Summary of notification or non-compliance	Reason	Measures taken to prevent reoccurrence
26/01/2022	Emissions Exceedance	An emergency boiler trip occurred due to a boiler tube leak which caused an exceedance of the CO daily average and CO 10-minute average 95%ile.	Following the shutdown, the failed tube was inspected, repaired and an assessment undertaken to identify the root cause of the failure.
04/02/2022	Emissions Exceedance	A combination of the fuel supplied, and the design control range of the boiler resulted in an exceedance of the CO 10-minute average 95%ile.	An investigation was implemented to determine and implement modifications to the plant.
05/02/2022	Emissions Exceedance	An unplanned shutdown due to the simultaneous failure of two of the bottom ash conveyors resulted in a single exceedance of the CO 10-minute average 95%ile.	An investigation was implemented to determine and implement modifications to the plant.
06/02/2022	Emissions Exceedance	An issue with the passing fuel feed chute auto fire deluge valve led to poor combustion when transferring to wood fire from oil which caused an exceedance of the CO daily average, CO 10-minute average 95%ile and an exceedance of the TOC half hour average	Plans in place to modify and improve the combustion control system to further extend the control range and reduce the reliance on operator intervention.
22/02/2022 &	Emissions Exceedance	A boiler tube leak and subsequent boiler safety trip caused an exceedance of the	A program of remedial works was carried out during the planned outage.

Date	Summary of notification or non-compliance	Reason	Measures taken to prevent reoccurrence
23/03/2022		CO daily average, CO 10 minute average 95%ile, NOx daily average, NO_x half hour average, SO_2 daily average, SO_2 half hour average, TOC daily average, TOC half hour average, HF half hour average, particulate matter daily average and particulate half hour average.	
28/02/2022	Emissions Exceedance	The plant had been offline for most of the day, an exceedance during the soot blowing sequence resulted in an exceedance of the particulate matter daily average.	A toolbox talk has been issued to all operators highlighting the event and instructing operators to carefully consider the time of day, number of and possible number of valid periods remaining in the period before conducting operational activities that may change emissions. In addition, a calculation tool for predicting emissions limits based on the actual and forecast remaining periods is available to operations.
08/04/2022	Emissions Exceedance	A boiler tube leak and subsequent boiler safety trip caused exceedances of the SO_2 half hour average, TOC daily average, TOC half hour average, HF half hour average and particulate matter half hour average.	The site testing and maintenance schedule for the UPS batteries has been revised to test the battery condition more frequently as the OEM states.
10/04/2022	Emissions Exceedance	Exceedance occurred during the transition to wood fire that resulted in an exceedance of the CO daily average.	The site plans to modify and improve the combustion control system to further extend the control range and reduce the reliance on operator intervention.
13/04/2022	Emissions Exceedance	A boiler trip occurred following a communication loss between the boiler control system (BCS) and the DCS	Modifications planned for next outage.

Date	Summary of notification or non-compliance	Reason	Measures taken to prevent reoccurrence
		which resulted in an exceedance of the TOC half hour average.	
20/05/2022	Emissions Exceedance	An unplanned closure of the boiler main primary air damper caused an exceedance of the SO_2 half hour average, TOC daily average, TOC half hour average and particulate matter half hour average.	Site management instruction – SMI-MA-018-WID Maintenance of Safety critical instruments, has been updated.
05/07/2022	Fugitive Emission	Smoke from combustion wood.	Feedback to fuel supplier undertaken and routine inspection and cleaning of separator frequency increased.
15/07/2022	Emissions Exceedance	Following maintenance on the fuel feed conveyors and during transition back to wood fire a single exceedance of the CO 10-minute average 95%ile was recorded.	The event was investigated, and the control system analysed for potential improvements.
13/05/2022	Non-Compliance	CAR Form received following a site inspection on 06/05/2022 and the review of Q1 2022 emissions monitoring submission. Total of 4.2 CCS points received	The main issues were related to changes to the DCS controls to improve combustion management, control of emissions and timely reporting of exceedances.
20/09/2022	Non-Compliance	CAR Form received following the review of Q2 2022 emissions monitoring submission. Total of 4.5 CCS points received	The main issues were related to the management system, specifically the UPS battery testing schedule, air control, DCS and safety critical systems.
13/12/2022	Non-Compliance	CAR Form received following the review of Q3 2022 emissions monitoring submission. Total of 0.1 CCS points received	Score received for emissions exceedance during the period.

5.2 Summary of any complaints received and actions to taken to resolve them.

Date of complaint	Summary of complaint	Reason for complaint including whether substantiated by the operator or the EA	If substantiated, measures to prevent reoccurrence
N/A	None	None	None

6 Summary of Plant Improvements

Summary of any permit improvement conditions that have been completed within the year and the resulting environmental benefits.
All improvement conditions have been discharged.
Summary of any changes to the plant or operating techniques which required a variation to the permit and a summary of the resulting environmental impact.
There have been no changes to the plant operating techniques during 2022.
Summary of any other improvements made to the plant or planned to be made and a summary of the resulting environmental benefits.

Appendix A Reporting Forms