

Widnes Biomass Facility

MERSEY BIOENERGY LTD

Annual Performance Report 2018



Annual performance report for
Widnes Biomass Facility

Permit number: EPR/JP3132RV

Board Meeting Agenda

Year: 2018

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WIDNES BIOMASS
CHP PLANT

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Appendices

- A Reporting Forms

Quality Management

Issue	Date Issued	Issued by
Internal	30 th January 2019	LP
Rev 1	31 st January 2019	LP
<u>Rev 2</u>	<u>17th April 2019</u>	<u>LP</u>

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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 Albany SPC Services Ltd 3-5 Charlotte Street Manchester M1 4HB widnes@infraconsult.co.uk

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

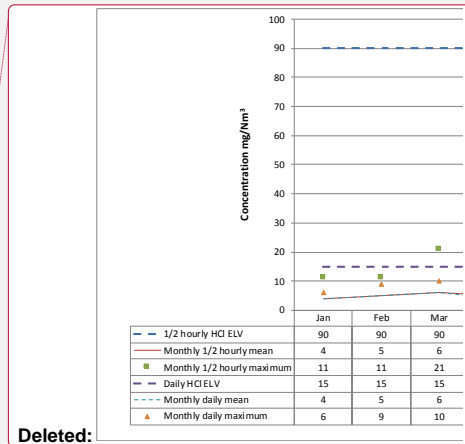
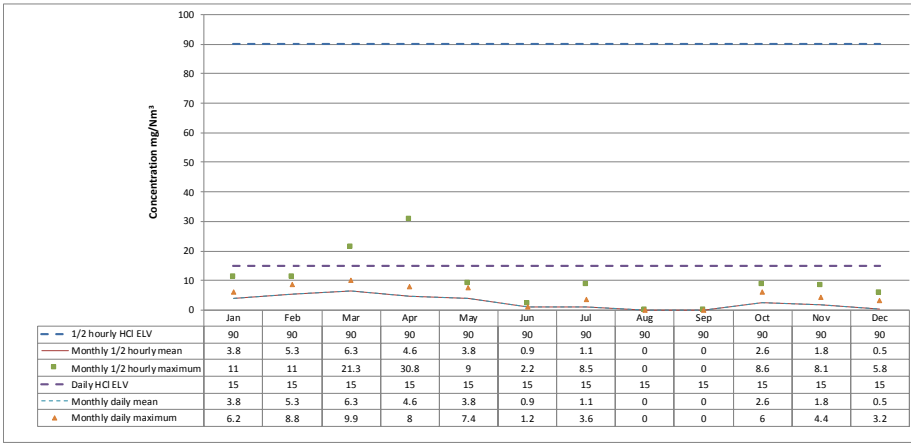
Waste wood (biomass) received	88,076.89 tonnes
Total waste received	88,076.89 tonnes
Total plant operational hours	5,027 hours
Total hours of "abnormal operation" (see permit for definition)	3.5 hours
Total quantity of incinerator bottom ash (IBA) produced	3,529.32 tonnes
Disposal or recovery route for IBA	Hazardous Landfill
Did any batches of IBA test as hazardous? If yes, state quantity	Yes 26 samples (2 per month for 13 months) classified as hazardous (HP4, HP8 and HP14)
Total quantity of air pollution control (APC) residues produced	1,667.68 tonnes
Disposal or recovery route for APC residues	Hazardous Landfill
Total electricity generated for export to the National Grid	89,309.97 MWh
Total heat produced for export (e.g. to hospital or district heating scheme)	34,578.43 MWh

4 Summary of Plant Emissions

4.1 Summary of continuous emissions monitoring results for emissions to air

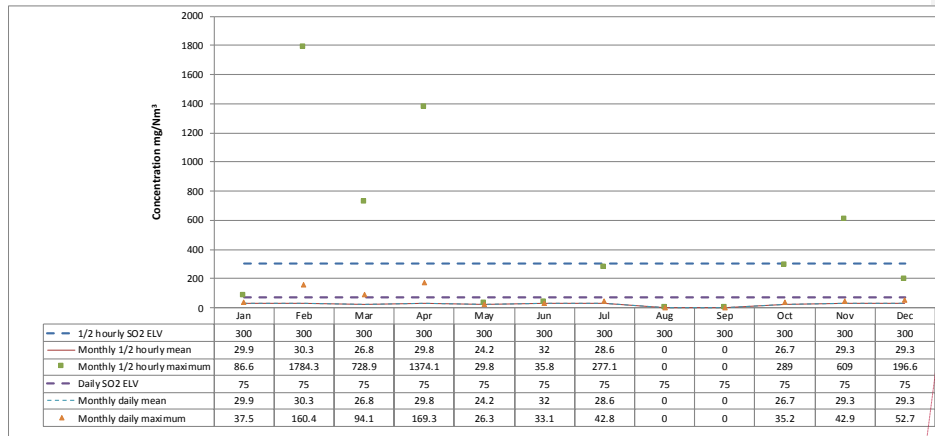
The following charts show the performance of the plant against its emission limit values (ELVs) for substances that are continuously monitored.

Line 1 - Hydrogen chloride

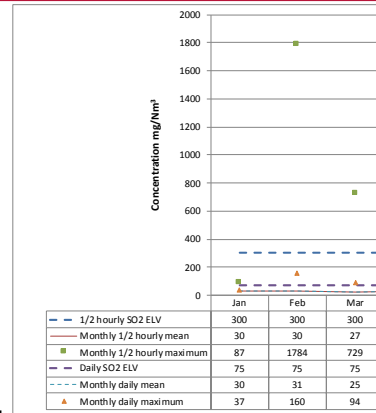


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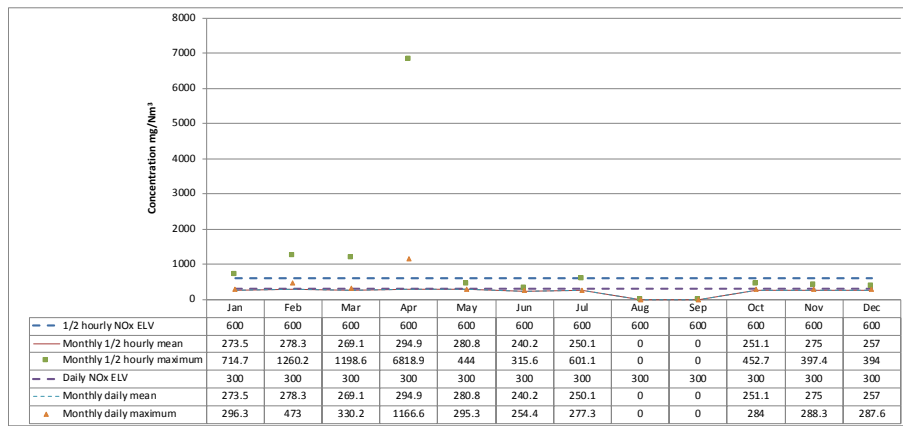
Line 1 – Sulphur dioxide



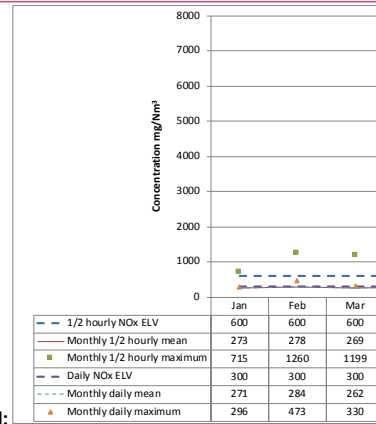
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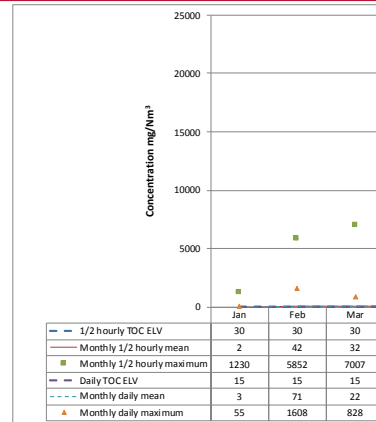
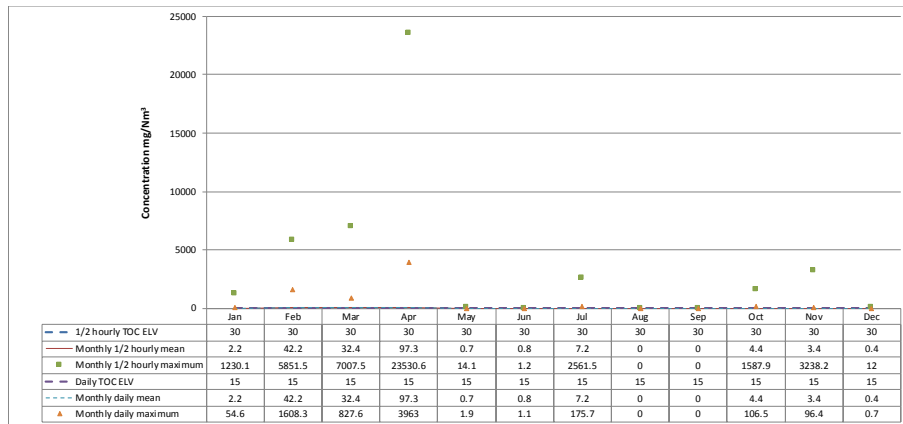
Line 1 – Oxides of nitrogen



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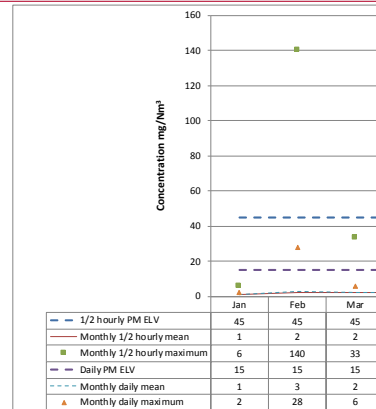
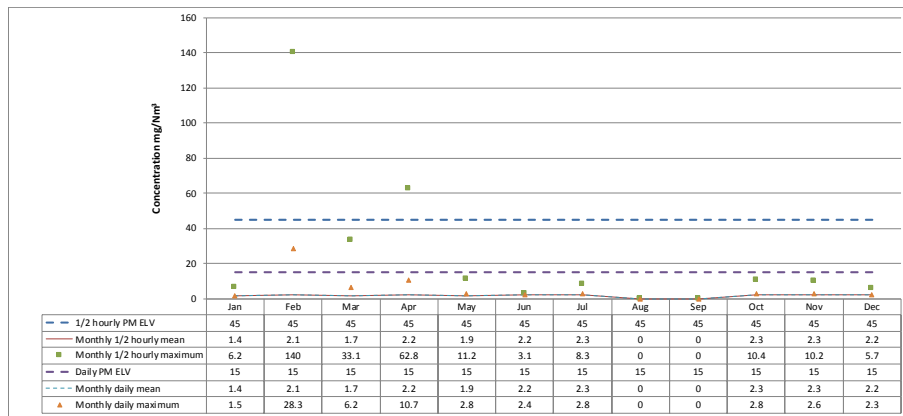


Line 1 – Total organic carbon



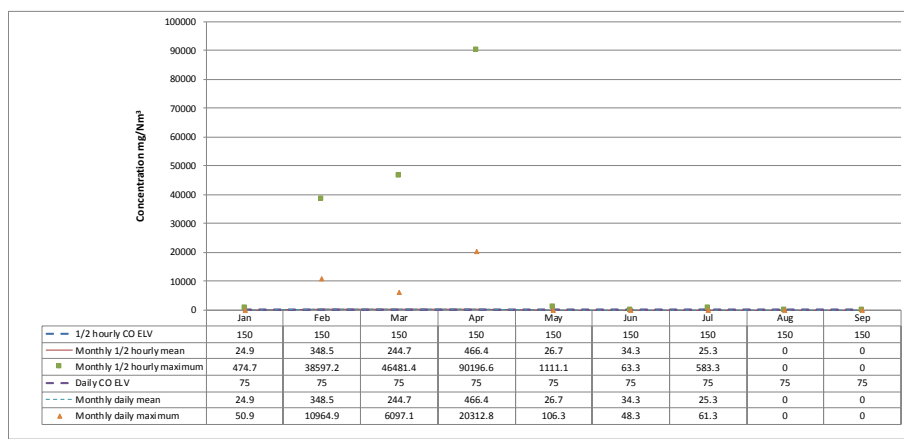
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Line 1 – Particulates

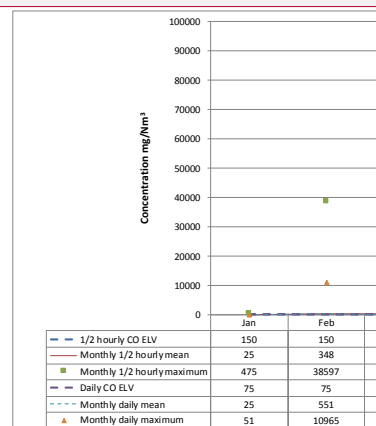


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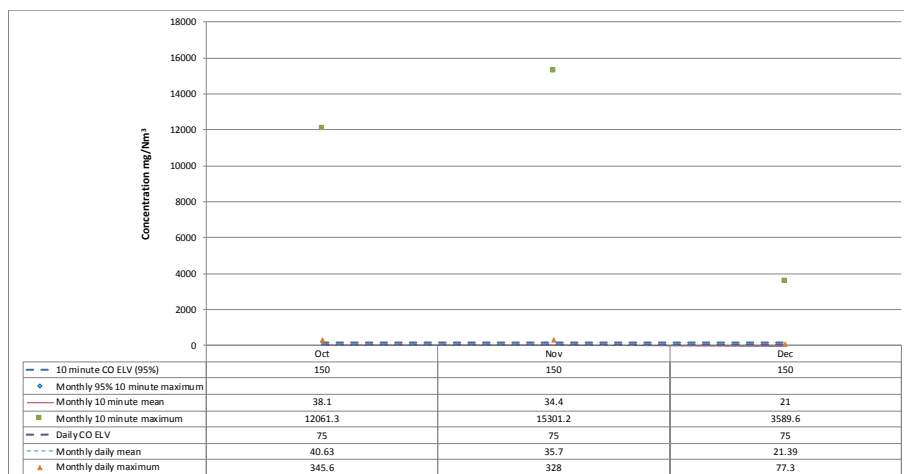
Line 1 – Carbon monoxide



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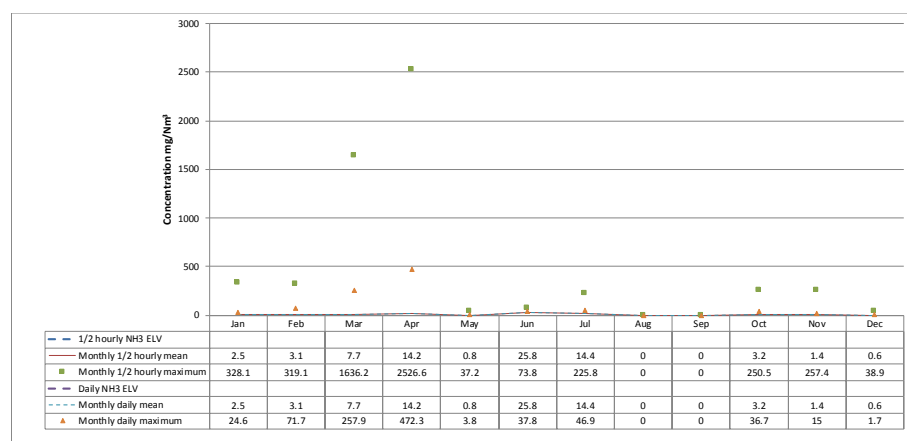


The Permit was varied in September 2018 to allow reporting of 10 minute averages for Carbon Monoxide. Therefore, data from October 2018 onwards is of this data.



Deleted: However, the data currently available from the CEMS system has been incorrectly printed with the previous 30 min ELV instead of the new 10 min ELV – this data is currently being rectified, and will be submitted as soon as available.†

Line 1 – Ammonia



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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			
		05/03/2018 – 07/03/2018	08/05/2018 x	01/11/18*	18/12/18
Mercury and its compounds	0.05 mg/m ³	< 0.0004 mg/m ³	-	0.0008 mg/m ³	<0.001 mg/m ³

Substance	Emission limit value	Results			
		05/03/2018 – 07/03/2018	08/05/2018 ^x	01/11/18*	18/12/18
Cadmium & thallium and their compounds (total)	0.05 mg/m ³	0.0037 mg/m ³	-	0.004 mg/m ³	0.003 mg/m ³
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total)	0.5 mg/m ³	0.0722 mg/m ³	-	0.14 mg/m ³	0.065 mg/m ³
Dioxins and furans (I-TEQ)	0.1 ng/m ³	0.1025 ng/m ³	0.006 ng/m ³	0.001 ng/m ³ *	0.0043 ng/m ³
Hydrogen Fluoride	3 mg/m ³	0.13 mg/m ³	-	< 0.02 mg/m ³	< 0.79 mg/m ³

^x Testing in May 2018 was retest for Dioxins and furans only, following failure of emission limit value in March 2018

* Q3 testing for Dioxins and furans was carried out on 14/11/18

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
01/01/18	Half-hourly CO ELV exceedance (2 occurrences)	Fault on boiler hydraulic grate limit switch leading to fuel disturbance and uneven fuel distribution.	Warranty defect entered re ongoing requirement to adjust grate limit switch settings to enable continued service of the boiler within the parameters of the Environmental Permit. Boiler OEM investigating.
04/01/18	Half-hourly CO ELV exceedance	Changes made to combustion air flow set points: O ₂ and secondary air increased, and recirculation gas trimmed. The boiler load was incrementally increased from 80% to 90% and emissions monitored. At 90%, a short period CO spike was observed, therefore boiler load was reduced back to 80%.	Boiler load restricted to 80% while testing and commissioning team liaising further with boiler OEM.
04/01/18	Lime dosing stoppage	Lime system high pressure alarm;	System modified so failed coupler is no longer required

Date	Summary of notification or non-compliance	Reason	Measures taken to prevent reoccurrence
		investigation found that pipework coupler had failed.	
05/01/18	Half-hourly CO ELV exceedance	Transient high CO during plant trip caused by drum level swing during boiler feed pump change over (Duty to Standby)	Boiler protection operated as designed due to low drum level experience during boiler feed pump change over from duty to standby pump
09/01/18	Half-hourly CO, TOC and NOx ELV exceedances Daily TOC ELV exceedance	Boiler tripped due to inadvertent operation of emergency push button	Warranty defect entered re suitability of emergency push buttons due to risk of accidental operation. Revised covers ordered and installed.
11/01/18	Powdered Activated Carbon (PAC) dosing system blockage	PAC feed blockage prevented system from dosing correctly. PAC has potentially been exposed to excessive moisture ingress or cold causing leading to condensation causing the material to hang up.	PAC currently stored in a bespoke open sided storage shed; plastic strip covers have now been installed to protect the bags from weather conditions. In addition, a working stock of bags has been moved to an indoor location to ensure they are dry before use.
13/01/18	Half-hourly CO ELV exceedance	Combustion control adjustments made in conjunction with T&C and boiler OEM. Boiler load steadily increased and	Boiler OEM & T&C continued boiler tuning

Date	Summary of notification or non-compliance	Reason	Measures taken to prevent reoccurrence
		monitored on the 12/01/18. CO spike occurred early the following morning and consequently load reduced back to 80% for further work on boiler controls.	
13/01/18	Half-hourly CO ELV exceedance	Boiler trip following problems with grate control and not reaching limits.	Warranty claim in place regarding reoccurring issues with grate limit switches. Boiler OEM investigating.
14/01/18	Half-hourly CO ELV exceedance	Grate bar position fault led to grate and fuel supply stoppage and interrupted and uneven fuel supply and distribution to boiler.	Faulty grate limit switch replaced and load reduced until combustion stable. Warranty form in place regarding reliability and suitability of hydraulic limit switches. Boiler OEM investigating.
18/01/18	Half-hourly NOx ELV exceedance	Fault on urea control system leading to loss of tank level indication and loss of confidence in flow meter reading.	Repairs completed by maintenance team and strategic spares available.
24/01/18	Half-hourly CO ELV exceedance	Control fault with fuel system load / unload conveyors preventing waste wood fuel supply to the boiler; boiler load reduced	Boiler grate cleaning, inspections and maintenance planned for annual outage in May 2018. Discussions ongoing with fuel handling OEM regarding the

Date	Summary of notification or non-compliance	Reason	Measures taken to prevent reoccurrence
		and reverted to oil firing due to low boiler fuel bin level. During the load reduction, the boiler grate jammed causing a boiler trip.	effectiveness of the magnetic separator.
05/02/18	Half-hourly CO ELV exceedance	Oil burners tripped during plant shutdown due to coincidental false fire alarm on adjacent air compressor plant.	Routine maintenance in place for air compressors. Oil burner maintenance completed during plant outage in May 2018 by OEM of the equipment.
09/02/18	Half-hourly CO ELV exceedance	Boiler fuel pusher limit switch fault let to uneven fuel distribution and combustion on the boiler grate.	Site Operating Procedure updated detailing actions to take in the event of a fuel supply failure from an individual fuel chute and uneven combustion. Procedure updated to include instruction to apply secondary and/or primary air to improve combustion conditions. All boiler grate and hydraulic limit switches cleaned and re sealed. Complete set of boiler hydraulic limit switch spares ordered and available in the event of a fault. Boiler grate inspected during

Date	Summary of notification or non-compliance	Reason	Measures taken to prevent reoccurrence
			the plant outage in May 2018 and remedial works completed, fuel stack rebuild and maintenance completed on the pusher hydraulics.
14/02/18	Half-hourly CO, TOC and NO _x ELV exceedances Daily CO and TOC ELV exceedances	Turbine & bypass station tripped due to high vacuum, caused by air ingress during condensate pump strainer cleaning; attributed to operator error. Boiler subsequently tripped due to low feedwater level.	Procedure for strainer cleaning reviewed. Operations team briefed on how the incident occurred, what subsequently led to the trip and the importance of following procedure in a step by step manner thus preventing air entering the condenser during this operational task.
15/02/18	Half-hourly CO ELV exceedance Daily NO _x ELV exceedance	Boiler grate limit switch faults caused uneven fuel supply and combustion on boiler grate.	All boiler grate and hydraulic limit switches cleaned and re-sealed. Complete set of boiler hydraulic limit switch spares ordered and available in the event of a fault. Hydraulic grate limit switches replaced during the plant outage in May 2018, and cable glands replaced with a set supplied by the OEM of the equipment.
27/02/18	Half-hourly CO, TOC and NO _x ELV exceedances Daily CO and	A frozen impulse line on the condensate pump discharge pressure indication led to a turbine trip	All plant indications identified which are at risk of freezing and temporary lagging and/or heat tracing applied. List supplied to

Date	Summary of notification or non-compliance	Reason	Measures taken to prevent reoccurrence
	TOC ELV exceedances	due to high condensate tank level; this subsequently caused a boiler trip.	plant EPC contractor who has implemented permanent measures to prevent freezing.
28/02/18	Half-hourly and Daily CO, TOC, NO _x , SO ₂ and Particulates ELV exceedances	Same occurrence as above (27/02/18), following the installation of pipe lagging. Instrument has subsequently been moved closer to the process measurement point reducing pipe length & heat tracing also applied along with insulation.	
06/03/18	Half-hourly CO ELV exceedance	Cause of emissions suspected to be fuel quality related as boiler load not reaching target set point.	Initially boiler load reduced as per operating procedure. Boiler combustion set points adjusted for fuel pusher and O ₂ controller. Combustion conditions monitored and further adjustments made if required.
07/03/18	Half-hourly CO ELV exceedance	Plant load reduced due to fresh air damper opening due to indication error. During this load drop, a primary air damper failed to reach its	All actuators health checked by the equipment OEM during the outage in May 2018 and dampers removed, inspected and replaced.

Date	Summary of notification or non-compliance	Reason	Measures taken to prevent reoccurrence
		required set point. The damper was manually set to the nominal running position and maintenance attended and rectified fault with actuator.	
14/03/18	Half-hourly CO ELV exceedance	Right hand fuel feed screw failed to start. Fuel shaft subsequently ran low on fuel. Shut off damper closed, leading to uneven combustion on grate. No clear root cause discovered, suspected to be transient blockage of chute level sensor preventing correct operation of feed screw.	OEM visited site prior to and during the May 2018 outage, calibration completed with a full and empty fuel stack to confirm correct operation.
15/03/18	Half-hourly CO ELV exceedance	Suspected to be due to fuel quality as no other operational changes coincide with exceedance.	Secondary/Primary air ratio optimised further to decrease primary and increase secondary air. Sample of fuel retained for further analysis if needed. Adjustments made as and when needed as per Ops guidance.

Date	Summary of notification or non-compliance	Reason	Measures taken to prevent reoccurrence
17/03/18	Half-hourly and Daily CO, TOC and NOx ELV exceedances	Turbine and bypass system tripped due to high level in condensate tank caused by suspected instrumentation issue (frozen impulse line). Subsequently the boiler tripped on drum level, resulting in full plant trip.	All plant indications identified which are at risk of freezing and temporary lagging and/or heat tracing applied. List supplied to plant EPC contractor who has implemented permanent measures to prevent freezing.
29/03/18	Half-hourly CO ELV exceedance	Fuel pusher fault experienced preventing fuel supply to one side of the grate resulting in unbalanced combustion and CO emission.	Operating procedure updated detailing actions to take in the event of a fuel supply failure from an individual fuel chute and uneven combustion. Procedure updated to include instruction to apply secondary and/or primary air to improve combustion conditions. Boiler grate inspected during the plant outage in May 2018 and remedial works completed, fuel stack rebuild and maintenance completed on the pusher hydraulics.
31/03/18	Half-hourly CO, TOC, SO ₂ and HF ELV exceedances Daily CO, TOC, SO ₂ and NOx ELV	Boiler trip due to ID fan drive fault	ID fan drive OEM visited site and completed full check on VSD system during outage in May 2018.

Date	Summary of notification or non-compliance	Reason	Measures taken to prevent reoccurrence
	exceedances		
02/04/18	Half-hourly CO ELV exceedance	Primary air damper failed to reach set point from combustion air control system leading to insufficient primary air to grate section.	Damper adjusted manually to nominal running position. Damper actuator limits set by site maintenance team. Primary air dampers removed cleaned and actuator health checked during the outage in May 2018.
02/04/18	Half-hourly CO, TOC, SO ₂ , NO _x , HF and Particulates ELV exceedances Daily CO, TOC, SO ₂ and NO _x ELV exceedances	Boiler trip due to drum level indication discrepancy during boiler feed pump change over.	Boiler level transmitter OEM has attended site to set up and calibrate drum level transmitters (partially completed). Boiler feed pump control logic review ongoing with boiler OEM.
08/04/18	Half-hourly CO and TOC ELV exceedances Daily CO ELV exceedance	During plant shutdown boiler drum emergency valve went into fault condition leading to a high drum level boiler trip	Valve actuator limits set by maintenance team. Valve overhauled during plant outage in May 2018; some damage to valve cage discovered and polished out, actuator health-checked and set up.
10/04/18	Half-hourly CO, TOC and NO _x ELV exceedances Daily CO ELV exceedance	Boiler tripped due to activation of ID fan low low pressure alarm and protection during sootblowing operations.	ID fan control, trip settings & physical design reviewed and control changes implemented to prevent re occurrence

Date	Summary of notification or non-compliance	Reason	Measures taken to prevent reoccurrence
24/04/18	Half-hourly CO ELV exceedance	During a load reduction to complete fuel supply conveyor maintenance a CO exceedance was seen as the boiler load dropped to 60%.	<p>Instruction given to operations department not to set boiler load lower than 65%.</p> <p>Also during low load operation, monitor CO and adjust secondary air supply if needed.</p> <p>Warranty claim submitted to boiler OEM regarding air control at low load.</p> <p>Boiler OEM representative attended site for a considerable period and adjusted the air control at low loads.</p>

Date	Summary of notification or non-compliance	Reason	Measures taken to prevent reoccurrence
01/05/18	Half-hourly and Daily CO ELV exceedances	Boiler firing on oil due to issue with waste conveyor feed system; trip occurred initiating a shut down. CEMS waste signal active whilst no waste burn in progress due to slide damper 3 not meeting its limit switch and turning the waste signal off; the conditions for the waste signal to be off would have been met at less than the 20 minutes required for a valid 30 minute period and should not have been recorded as there was no waste being incinerated at the time of the report.	Maintenance required on fuel slide damper and limit switch operation
02/05/18	Half-hourly CO ELV exceedance	During boiler start-up phase, fuel bridged in one of three fuel supply chutes. This then subsequently cleared leading to un even fuel distribution and combustion on the grate.	Operating procedure issued detailing actions to take in the event of a fuel bridge on start up. Actions include methods of clearing the blockage and instruction to switch oil burners to manual to stabilise and ensure complete combustion on grate whilst fuel distribution

Date	Summary of notification or non-compliance	Reason	Measures taken to prevent reoccurrence
			is uneven.
11/05/18	Half-hourly CO ELV exceedance	Occurred when increasing boiler load / between 80 and 90% load	
04/07/18	Half-hourly CO, TOC and NOx ELV exceedances Daily TOC ELV exceedance	Boiler tripped on low drum level due to feed water regulating valve actuator tripping on high torque.	Valve actuator OEM site visit arranged to assess torque requirement and test valve operation. The issue was deemed to be transient, and nothing conclusive was determined. No changes were made to torque settings, but the valve was heath-checked and the control monitoring changed.
12/10/18	10-minute CO ELV exceedance Half-hourly TOC ELV exceedance Daily CO and TOC ELV exceedances	Boiler tripped on low drum level protection.	Engineering review of boiler drum level control performance initiated. Temporary mitigation added to operating procedure whilst engineering review in progress.
12/10/18	10-minute CO ELV exceedance Half-hourly TOC ELV exceedance Daily CO and TOC ELV exceedances	Boiler tripped on low drum level protection following a turbine load increase.	
18/11/18	10-minute CO	Speed and control of	Control changes have been

Date	Summary of notification or non-compliance	Reason	Measures taken to prevent reoccurrence
	ELV exceedance Half-hourly TOC and SO ₂ ELV exceedances Daily CO and TOC ELV exceedances	the turbine bypass valve contributed to a boiler trip on low drum trip.	implemented to decrease the speed of the bypass valve movement under specific circumstances.

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
2018	None		

6 Summary of Plant Improvements

<p>Summary of any permit improvement conditions that have been completed within the year and the resulting environmental benefits.</p> <p>IC1: Written report on the implementation of the Environmental Management System, submitted January 2017. Schedule for certification of EMS is ongoing.</p> <p>IC2: Written proposal to carry out tests to determine the size distribution of the particulate matter in the exhaust gas emissions to air from emission point A1, identifying the fractions within the PM10, and PM2.5 ranges, submitted April 2018.</p>
<p>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.</p> <p>Variation to the Permit granted in September 2018 for reporting of CO emissions against 10 minute ELV, rather than Half Hourly ELV.</p>
<p>Summary of any other improvements made to the plant or planned to be made and a summary of the resulting environmental benefits.</p> <p>Further improvements have been made to the separation and extraction of the waste streams (ferrous, non-ferrous and oversize), and to the fuel unloading buildings, and the installation of dust retention curtains in front of the fuel cells, to mitigate fugitive emissions of dust.</p> <p>Improvements have been made to the ID fan margin and excess air resulting in lower CO formation.</p>

Appendix A Reporting Forms

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