

Annual Report

Environment Permit Condition 4.2.2

January 2017

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1. INTRODUCTION

This report fulfils the requirements of permit condition 4.2.2 of Environmental Permit LP3131TA in relation to;

Blackburn Meadows Renewable Energy Plant
Alsing Road
Sheffield
S9 1HF

Copies of this report are available by making a request in writing to the address above.

2. PLANT DESCRIPTION

Blackburn Meadows is a biomass fired renewable energy plant. The Installation is designed to process 250,000 tonnes of biomass per year and export up to 30 MWe of electricity and up to 25 MWth of heat. It is owned by E.ON Climate and Renewables and is located 5km North East of Sheffield to the East of the M1 Tinsley Viaduct in Blackburn Meadows on land off Alsing Road. It is about 400 meters North East of the Meadowhall shopping centre.

Biomass is delivered by road and unloaded into the fuel store by conveyor from the tipping area. The entire unloading process is conducted in an enclosed space. Any ferrous material is removed by magnetic separators during conveyance to the fuel store.

The biomass is removed from the fuel store by moving floor conveyors and loaded into the feed chute for delivery to the combustion unit. This is a bubbling fluidised bed design which ensures homogeneous mixing of the biomass with bed material and leads to good combustion. Residues from the combustion chamber are drawn down from the bottom of the bed and passed through a classifier. This separates out and cools the coarse particles and allows the fine particles to be returned as bed material. Surpluses are diverted via a blow pot to a boiler ash silo. Ash will be transferred off site for recovery or disposal at a suitably licenced facility.

Emissions of nitrogen oxides are controlled by the injection of urea into the combustion chamber. Hot gases from the combustion are passed through a boiler to raise steam. The steam is then passed to a steam turbine to generate electricity for export to National Grid, before being condensed in an air-cooled condenser and returned to the boiler. The combustion gases are cleaned in a flue gas treatment plant. This includes the injection of carbon, primarily to control dioxin emissions, the injection of lime, to control acid gas emissions, and the use of a fabric filter to remove dust. The cleaned exhaust gases are released to atmosphere via a 90 metre stack.

There are emissions to sewer for process water arising from boiler blow-down and cleaning. There are no process emissions to water.

3. SUMMARY OF PLANT OPERATIONS

2016 was the second full year of operation for Blackburn Meadows. Key activities and achievements in 2016 include;

- A planned outage to conduct maintenance and statutory inspections in June 2016;
- Expansion of the district heating system – additional customer base has seen waste heat utilisation increase by over 240%;
- ISO14001 re-certification of fleet-wide Environmental Management System in October 2016;
- Lime optimisation work initiated to review maximising the efficiency of the lime dosing system;
- Completion of CCTV drainage system survey;
- Bunding and drainage pit civil inspections;
- Submitted Blackburn Meadows as a reference plant for the forthcoming Waste Incineration BREF;
- Environment Agency emissions to air self-monitoring OMA audit in November, scoring 100%

The site has one incineration line with a throughput of up to 250,000 tonnes per year. A permit variation was implemented at the end of 2015 to increase the amount of waste which can be accepted on site from 200,000 tonnes to 250,000 tonnes per year, this allows for the variable moisture levels of the fuel. In 2016, 206,263 tonnes of fuel was burnt to produce 260,430 MWhrs of electricity and 8,990 MWth of heat. 100% of the biomass burnt was waste wood.

Table 1: Plant operation details for 2016

Biomass Incinerated	206,263 tonnes
% Biomass which is waste	100%
Electricity Produced	260,430 MWhrs
Electricity Exported	232,649 MWhrs
Incinerator bottom ash produced	4177 tonnes
Boiler Ash produced	2028 tonnes
APC Residues produced	5503 tonnes

4. SUMMARY OF EMISSIONS TO AIR

Emissions from Blackburn Meadows are controlled by the sites Environment Permit. The flue gas releases into the atmosphere are continuously monitored for particulate matter (dust), carbon monoxide (CO), sulphur dioxide (SO₂), hydrogen chloride (HCl), oxygen (O₂), nitrogen oxides (NO_x), ammonia (NH₃) and volatile organic compounds (VOC). In addition, periodic sampling and measurement is carried out for hydrogen fluoride (HF), nitrous oxide (N₂O), heavy metals, dioxins and furans, and dioxin like PCB's.

Daily average emissions for the emissions species continuously monitored is shown in table 2 below. Table 3 shows the average emissions for the species measured on a periodic basis.

Table 2: Summary of Emissions to Air in 2016 – Continuous Monitoring

Parameter	Daily Limit	Daily Average 2015	Daily Average 2016
Particulate Matter (PM)	15 mg/m ³	0.01 mg/m ³	0.00 mg/m ³
Total Organic Carbon (TOC)	15 mg/m ³	0.2 mg/m ³	0.2 mg/m ³
Hydrogen Chloride	15 mg/m ³	4.9 mg/m ³	5.5 mg/m ³
Carbon Monoxide (CO)	75 mg/m ³	16.8 mg/m ³	16.1 mg/m ³
Sulphur Dioxide (SO _x)	75 mg/m ³	10.5 mg/m ³	13.5 mg/m ³
Oxides of Nitrogen (NO and NO ₂ as NO ₂)	235 mg/m ³	155.0 mg/m ³	179.3 mg/m ³
Ammonia (NH ₃)	No limit set	3.1 mg/m ³	2.2 mg/m ³

**All data are shown as the confidence adjusted values except Ammonia, where no confidence interval has been removed and is the average of all the daily averages for the year. Days where the average is zero are not included.*

Table 3: Summary of emissions to air – Periodic Monitoring

Parameter	Daily Limit	Average for 2015	Average for 2016
Hydrogen Fluoride	3 mg/m ³	0.04 mg/m ³	0.05 mg/m ³
Cadmium and thallium and their compounds (total)	0.05 mg/m ³	0.00 mg/m ³	0.00 mg/m ³
Mercury and its compounds	0.05 mg/m ³	0.00 mg/m ³	0.00 mg/m ³
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total)	0.5 mg/m ³	0.13 mg/m ³	0.02 mg/m ³
Nitrous Oxide (N ₂ O)	No limit set	35.02 mg/m ³	10.8 mg/m ³
Dioxins and Furans (I-TEQ)	0.1 ng/m ³	0.00 ng/m ³	0.01 ng/m ³
Dioxins and Furans (WHO-TEQ Humans / Mammals)	No limit set	0.00 ng/m ³	0.01 ng/m ³
Dioxins and Furans (WHO-TEQ Fish)	No limit set	0.00 ng/m ³	0.01 ng/m ³
Dioxins and Furans (WHO-TEQ Birds)	No limit set	0.01 ng/m ³	0.01 ng/m ³
Dioxin-like PCB's (WHO-TEQ Humans / Mammals)	No limit set	0.32 ng/m ³	0.00 ng/m ³
Dioxin-like PCB's (WHO-TEQ Fish)	No limit set	0.00 ng/m ³	0.00 ng/m ³
Dioxin-like PCB's (WHO-TEQ Birds)	No limit set	0.02 ng/m ³	0.06 ng/m ³
Specific individual poly-cyclic aromatic carbons (PAH's) as specified in schedule 6	No limit set	1.65 ug/m ³	0.39 ug/m ³

** N₂O number is the average of the two tests as required for BS EN 21258. All 2016 averages are the averages of 2 sets of periodic monitoring taken throughout the period.*

5. WASTES AND BY-PRODUCTS

Blackburn Meadows is a waste acceptance facility and takes waste wood to fuel the boiler from a local supplier. All waste received in 2016 was EWC code 19 12 07 and was waste wood (grade C3), which was otherwise destined for landfill.

A by-product of the combustion process is ash which must be disposed of offsite as waste. Blackburn Meadows has three separate ash streams (quantities of ash produced in 2016 can be seen in table 1 above):

- Incinerator bottom ash – sand and coarse stones from the boiler bed;
- Boiler dust – finer material which is carried through the boiler, and;
- Air Pollution Control (APC) residues – residues from the bag filters.

During 2016, a washing trial has been undertaken with the incinerator bottom ash stream to segregate the ash into the 4 main constituents; clean sand, metal, rubble/aggregate material and a filter cake. Work is ongoing to find reuse outlets for these streams to divert them from landfill. The two remaining ash streams (boiler ash and APCR) were disposed of to landfill during 2016. E.ON is working with the ash disposal company to focus on finding viable reuse / recycling options for these ash streams in the forthcoming year.

The annual tonnage of other wastes on site is shown in table 4 below. The majority of the general non-hazardous waste is from soil and stones recovered during construction activities and metal materials which are recovered from the fuel prior to incineration. Additionally, during the outage period the drainage system and oil separation system was emptied and cleaned, giving rise to 11.4 tonnes of additional hazardous waste. Blackburn Meadows recovered over 95% of the non-hazardous waste streams produced on site in 2016, predominantly via recycling & reclamation routes.

Table 4: Other wastes produced in 2016

EWC Code	Waste Description	Annual Tonnage
20 03 01	General non-hazardous waste	42
15 01 06	Dry mixed recycling	2.8
17 06 04	Insulation materials	1.4
16 10 02	Gully waste	10.5
20 01 40	Metal	100
17 05 04	Soil and stones	280
10 01 14*	Extraction dust	3
13 05 08*	Oil / water from oil separators	11.4
-	Wood Wastes	18.4
-	Other Hazardous wastes (all excluding ash)	5.57

*There are other ad hoc wastes which are produced on site (e.g. in an outage) - the above represents waste from normal day to day operations.

6. ANNUAL PRODUCTION / TREATMENT (S4.2)

The annual production and treatment data as required by Table S4.2 of the Environment Permit is shown in table 5.

The amount of biomass combusted in 2016 was slightly less than in 2015; however the overall generation has increased over 2015 figures owing to operational experience and efficiency measures which have improved the overall efficiency of the plant.

Fuel oil is used for start-up and shut down and to support the boiler if the temperature drops or combustion is unstable. Fuel oil consumption was lower due to the continued stable baseload operation and in which the plant ran during 2016 and the swift return to service following the outage.

The district heating system has delivered significantly more heat to customers in 2016 compared to 2015 following an increase in the numbers of customers who have been connected to network, and it is anticipated that this will continue to increase as the district heat network expands further.

Table 5: Annual production and treatment data

Parameter	Units	2015	2016
Total biomass combusted	tonnes	215,615	206,232
Total Waste biomass combusted (included in the above figure)	tonnes	215,615	206,232
Total auxiliary fuel oil used	tonnes	287	218
Electrical energy produced	KWhrs	255,972,353	260,429,948
Thermal energy produced e.g. steam	KWhrs	2,617,690	8,989,900
Electrical energy exported	KWhrs	228,959,027	232,648,550
Electrical energy used on installation	KWhrs	27,736,686	28,142,745
Waste heat utilised by the installation	KWhrs	0	0

7. PERFORMANCE PARAMETERS (S4.3)

The performance parameters required by Table S4.3 of the Environment Permit is shown in table 6. The plant operated a baseload regime throughout 2016 and production was fairly stable. There was a planned outage from the end of June to the beginning of July which contributed to the higher electricity import and less biomass burn (due to the plant being offline) and higher fuel oil consumption (for start-up and shut down) seen in Q2 & Q3. Bottom ash produced increased in the quarter due to a dig out of the fluidised bed as part of the planned outage works, and water consumption increased in Q3 as the boiler was drained during the outage and had to be subsequently replenished.

Table 6: Quarterly performance parameters shown per tonne of biomass combusted

Parameter	Units	Q1	Q2	Q3	Q4	Total
Electrical energy imported at the installation	KWhrs / tonne of biomass	0.14	4.41	6.32	0.90	2.67
Electrical energy exported at the installation	KWhrs / tonne of biomass	1055.61	1156.51	1175.48	1144.11	1127.92
Electrical energy used at the installation	KWhrs / tonne of biomass	122.72	137.55	150.98	138.85	136.44
Fuel oil consumption	tonnes / tonne of biomass	0.000	0.003	0.002	0.000	0.001
Mass of Bottom Ash produced	Kg / tonne of biomass	17.28	29.72	17.87	16.96	20.25
Mass of APC residues produced	Kg / tonne of biomass	28.05	27.78	24.11	26.25	26.68
Mass of Other solid residues produced	Kg / tonne of biomass	9.39	12.06	5.01	12.34	9.83
Urea consumption	Kg / tonne of biomass	11.16	14.01	14.03	14.90	13.41
Activated Carbon consumption	Kg / tonne of biomass	1.37	1.81	1.76	1.53	1.50
Lime consumption	Kg / tonne of biomass	5.62	5.62	4.83	6.66	5.58
Water consumption	m ³ / tonne of biomass	0.23	0.32	0.41	0.35	0.32
Periods of WID abnormal operation	No of occasions and cumulative hours for current calendar year	0	1	2	4	7

8. INCIDENTS AND COMPLAINTS

There were no environmental incidents at Blackburn Meadows in 2016. There were no justified complaints.