Annual Performance Report for Boiler 7 Renewable Energy process at Shotton Paper during 2018

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Utilities Manager

This report has been written to meet the requirements of Article 12 (2) of the Waste Incineration Directive 2000/76/EC(WID)

"For incineration or co-incineration plants with a nominal capacity of two tonnes or more per hour and notwithstanding Article 15(2) of Directive 96/61/EC, an annual report to be provided by the operator to the competent authority on the functioning and monitoring of the plant shall be made available to the public. This report shall, as a minimum requirement, give an account of the running of the process and the emissions into air and water compared with the emission standards in this Directive."

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1. Introduction

The principle of Boiler 7 design of the plant was to burn all the site sludge produced from the de-inking and effluent treatment processes on site. The volume of sludge being generated on site remains lower than design due to the shutdown during 2015 of a proportion of the paper manufacturing process.
Due to the low calorific value of the site derived sludge Boiler 7 also requires support fuel for the combustion process. This support fuel is supplied as Biomass in various forms i.e.mainly Recycled wood and Arbicultural arisings.
All the biomass is supplied to site by Tilhill who source the materials from various local forests and wood processors. The local authority recycled waste wood is prepared for use, on site and helps sustain the boiler operation.

2. Plant description

The Boiler 7 plant comprises of the following equipment:

- Wood Bio-fuel reception and processing
- Waste Wood Processing Plant
- Site-derived waste sludge and wood bio-fuel storage;
- Conveyor systems
- Boiler 7 furnace with High Pressure and Low Pressure steam turbines and all other associated equipment

Control of the combustion process remains highly automated with several layers of safeguards and interlocks built into the control strategy and hardware to ensure the operation is stable and conforms to the requirements of WID.

The use of the combustion optimisation package has continued in ensuring that combustion remains stable and maintain a good thermal efficiency.

3. Summary of Plant Operations

During the year the plant was operational for 8104 hours, with outages of 655 hours overall availability of 92.52%
The planned boiler outage took place during April 2018, with a number of unplanned shutdowns particularly in Quarter 1 with Economiser leaks
Output from the Boiler for the year remained at target levels of 34 kg/s.

During the year a high percentage of APC residues continue to be used at either cement block or cement replacement facilities. Various additional APC recycling outlets have been identified for which trials and approvals are ongoing with the relevant authorities.

Fuel Inputs

Fuel description	EWC code	Tonnes used
Site Waste Sludge	03 03 05	100235
Recovered bio-fuel	15 01 03 17 02 01 19 12 07 19 12 10 20 01 38	219032

Energy outputs

Description	Energy MWh	End Use
Electricity	157306	Supply of a portion of the electrical energy consumption for the site.
Process steam	260141	Supplied primarily to the pulp de-inking and paper manufacturing processes.
Process water heating	24932	Process water from the paper machine was heated through plate heat exchangers by re-circulated Flue gas scrubber shower water.

Waste outputs

Waste description	EWC code	Tonnes produced	End Use
Bottom Ash	19 01 11	6354	Hazardous waste landfill
Fly ash	19 01 13	6137	Blended with other wastes for various cement replacement products.
Fly ash	19 01 13	17105	Landfill

Non Waste Outlets	Tonnes produced	End Use
Fly Ash	17380	Block Industry

4. Summary of Plant Monitoring

The following air emissions from the plant have been measured and reported continuously:

Carbon Monoxide (CO)
Sulphur Dioxide (SO_2)
Total Organic Carbon (TOC)
Hydrogen Chloride (HCl)
Particulates
Oxides of Nitrogen (NO_X)
Ammonia

In addition to the continuous monitoring the following air emissions were measured and reported bi-annually as required by permitted conditions

Mercury
Cadmium and Thallium
Other Metals (Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V)
Hydrogen Fluoride (HF)
Dioxins and Furans

The continuous emissions monitoring system (CEMs) operated within the specified WID availability criteria throughout the year.

Results from the periodic air emission testing on Boiler 7 are given below

Pollutants	Q1/Q2 results mg/m3	Q3 / Q4 results mg/m3	Year Avg mg/m3
Mercury	0.002	0.0006	0.0004
Cadmium & Thallium	0.002	<0.0009	0.0015
Tin, Arsenic, Lead, Chromium, Cobalt, Copper, Manganese, Nickel, Vanadium	0.064	0.0314	0.0477
HF	0.05	<0.03	0.04
Dioxins / Furans (ITEQ)	0.0010	0.0004	0.0025

The ash residues produced by the process were also subject to a monitoring regime with analysis carried out quarterly for the following parameters:

Bottom Ash Weight loss on Ignition (LOI) as %
Bottom Ash heavy metals
Fly Ash heavy metals
Bottom Ash Dioxins and furans
Fly Ash Dioxins and furans

Results for Loss on Ignition (LOI) testing of Bottom Ash are given below

Parameter	Q1	Q2	Q3	Q4	Avg mg/m3
Bottom Ash LOI %	1.0	0.1	1.0	0.1	0.55

Results for Heavy Metal APC Residues are given below

Parameter	Q1	Q2	Q3	Q4	Avg mg/m3
Cd	4.2	2.1	20.1	2.4	2.8
Tl	< 1	< 1	< 1	< 1	< 1
Hg	0.1	.1	.1	.2	.11
Pb	858	483	466	660	602
Cr	110	105	120	127	112
Cu	525	638	457	538	540
Mn	670	479	550	575	566
Ni	34	28	31	35	31
As	61	54	55	50	57
Co	11	10.5	10.1	12	10.5
V	27	24	28	27	27
Zn	1822	1144	1213	1741	1393

5. Summary of Plant Compliance

Air Pollutants	EU Directive ELV (mg/Nm3)	Percentage compliance
Particulates	10	100
NO_X	200	100
SO_2	50	100
CO	100	100
HCl	10	100
HF	1	100
Volatile organic compounds (TOC)	10	100
Mercury	0.05	100
Cadmium and thallium	0.05	100
Sum of heavy metals (Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V)	0.5	100
Dioxins + furans	0.1 x 10-6	100
Ammonia	No Limit	N/A
CEMs operational when Boiler running	8072 hrs	99.60

There was a period during September of abnormal operation when the continuous monitoring system failed during this time alternative methods to control combustion where used however these where not seen as been complaint with our permit conditions and therefore raised as a non compliance

Furnace combustion performance

Bottom Ash	Unit	EU Directive ELV	Percentage compliance
Loss on Ignition	%	5	100

Flue gas scrubber performance

Scrubber bleed water parameters	Unit	EU Directive ELV	Percentage compliance
Total solids	mg/l	30	99.89
Hg	µg/l	30	100
Cd	µg/l	50	100
Tl	µg/l	50	100
As	µg/l	150	100
Cu	µg/l	500	100
Pb	µg/l	200	100
Cr	µg/l	500	100
Ni	µg/l	500	100
Zn	µg/l	1500	100

6. Summary of Plant Improvements

This has been another year of stability with no major changes to the fuel supply or volume of each fuel stream combusted.
The Low Pressure Condensing Turbine (LPCT) continues to deliver expected power generation.
A new Economiser section was fitted into the Boiler during the 2018 shutdown there was a change in design from finned type tubes to plain tubes and also an increase in the space between the tubes therefore reducing the localised flue gas velocities. To maintain overall thermal efficiency an extra economiser section was fitted, after 7 months of running this has been a good investment.
In addition work continues to develop alternative metals primarily within the superheaters to increase the Boiler plant availability.

7. Summary of information made available:

The information made available in this report and the detailed monitoring returns from the site are available on the Public Register at:
Environment Agency Offices, Chester

Signed

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